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PROCEEDINGS

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Philadelphia County Medical Society.

The Schott Method of Treating Diseases of the Heart and Bloodvessels.

By James M. Anders, M. D., LL. D.

[Read November 9, 1904.]

It may appear rather late in the day either to present the claims of the Schott methods of treating chronic cardiovascular diseases or to discuss the details connected with their application. It should ever be a feature of our therapeutic creed, however, to give close attention to physiologic means and to recognize their superiority over drugs as curative agencies. No one who views the immense concourse of persons pouring into Bad Nauheim from every part of the globe and notices the conditions presented by a small fragment even, as the writer has done, can fail of being impressed with the fact that confusion obviously reigns in the minds of a large proportion of the medical profession as to what constitutes a suitable case for this recognized mode of treatment. The same vagueness and indefiniteness of professional thought and action holds true at home, perhaps in greater degree than abroad, more especially in England, Germany and Russia—countries in which much attention has been paid to the subject. These facts furnish the *raison d'être* for attempting to extend a knowledge of the subject among the members of the profession of America, upon whom it unquestionably has strong claims. On the other hand, the Schott method of treating chronic cardiac diseases has not been as universally appreciated as it deserves. A transference of the point of view to an actual observance of the workings of the *kur* furnishes a clearer vision and serves to emphasize both its efficacy and the vastness of its sphere of usefulness.

Of the numerous health resorts that have risen to fame in recent

times, unquestionably Bad Nauheim heads the list, but its claims to public favor are not solely ascribable to the virtues of its healing waters as some contend, great as is their value, but, as will be shown hereafter, the "resistance exercises," which enter into the method of treatment herein described, form an element of almost equal therapeutic importance. Considerable attention is also bestowed upon the patients' dietary and hours for sleep and recumbency. Again, Nauheim has certain outside recommendations, and commands an attractive and restful environment. Beautifully embowered in a pretty park, lying near the foot of the Taunus mountain, are the commodious, cheerful and modern bath-houses *(bäder)*, while the springs, or underground streams, that supply them "without hurry and without rest," gracefully yield their healing waters from the great repositories of nature. Around this fairly extensive and pretty park cluster numerous stately villas, hotels, and, in the loftiest part stands out prominently the handsome "kurhaus," on the terrace of which there are daily concerts by an orchestra, and theatrical performances in the evening, the amusements offered being in keeping with the nature of a serious health resort.

One need not renounce modern comfort at Bad Nauheim. I gained the impression, however, that the healthy public might find this result dull, since conversation constantly involves excursions into the subject of chronic diseases of the heart and their treatment by the special method under consideration. This resort possesses certain minor climatic advantages; it is situated on the edge of a plateau (the Wetterau) at an elevation of 450 feet above the level of the sea, and the nights are always cool, owing to the nearness of the Johannisburg and the Woodland. There are also long, wide avenues with their cooling shade. Again, the sanitary arrangements are quite good.

In attempting to present the claims of the Schott methods of treatment of chronic cardiac diseases, as conducted at Nauheim, the writer is not unmindful of the existence of the excellent monograph of Bezly Thorne[1] and the papers published on the subject by Camac,[2] Tyson,[3] Baldwin[4] and others. These writers have given a creditable estimate of its advantages and have fully presented the details of its application, but they have scarcely formulated the whole truth in the premises. Moreover, the sceptically minded is among us; he who ascribes the *rationale* of the phenomenal results achieved to the good effects of rest and a peculiarly attractive environment. Granted that

a salubrious environment shares in the production of the beneficial effects, the principal and most influential factors to the attentive and practised observer are unquestionably the systematic and methodic use of the saline baths and the "resistance movements."

Time and space forbid my entering upon a full descriptive account of the baths and their constituents in this place. The springs are known both by names and numbers, but the former alone will best serve the purposes of this article.

The bath waters contain from 2 to 3 per cent. of sodium chlorid, from 2 to 3 per 1,000 of calcium chlorid, various forms of iron and above all a large amount of carbonic dioxid (Schott).[5] A course of baths embraces the use of waters of various strengths, ranging from the milder to the more potent with the progress of the cure, and the duration of the period of immersion is also variable. At the beginning, the waters of the so-called thermal baths are employed; they are freed to a certain extent from their natural gas. These are succeeded by the thermal-sprudel baths, then pure sprudel and finally, in a certain proportion of the cases, the so-called strom-sprudel. The baths intermediary between the thermal and effervescing (sprudel) are supplied from storage tanks. To render the baths more stimulating, so-called *"mutterlauge,"* which is the refuse of the salt manufactory in the neighborhood, is added in carefully increasing quantity in certain cases. The flowing sprudel (strom-sprudel) baths, which possess the greatest balneologic strength known, are most efficacious when judiciously and wisely employed. Here the waters of the principal springs forcibly enter, pass through and leave the bathtub during the period of immersion; it is the "bath of champagne."

It can be readily shown that the Nauheim waters offer more than simple saline baths, seeing that they contain carbon dioxid in solution and are also strongly ferruginous. Furthermore, the amount of carbon dioxid is far greater than that contained in any other bath on the continent. The physiologic effects of the mineral baths are at present writing fairly well understood, although at an earlier period of time they were used empirically as a remedy in rheumatism and later in chronic cardiac diseases. The baths exert a beneficial influence in various directions in cardiac insufficiency and prominent among the salient results are a more vigorous systole with diminution in the size of the dilated heart and a reduction of the pulserate. The diminution in the size of the heart is readily established both by percussion and the use of the X-rays.[6]

Of equal importance is the influence exerted upon the blood-paths by means of which there is accomplished an arteriodilation and a transfer of the abnormally large increment of venous blood to the arterial side of the circulation. The bloodpressure, as shown by Professor T. Schott,[7] is generally raised; but when it is too low at the start, this effect is not observed.

It is especially noteworthy that in consequence of a freer coronary circulation the impaired nutrition of the myocardium is correspondingly benefited. The labor of the overburdened heart is greatly diminished and its recuperation to a like extent assisted. Indeed, as the result of personal observation the writer is enabled to affirm that all of the usual evidences of an impaired circulation presented by the different organs (lungs, liver, stomach, kidneys), as well as the anasarca, disappear as the heart's capacity for physiologic work augments under the influence of balneologic therapy.

This effect upon the circulatory system is not due to a direct action of the baths, but an indirect one through irritation of the cutaneous sensory nerve filaments, the stimulation being conveyed to the vasomotor, cardiac and other nerve centres and producing an effect upon the organic functions and general nutritive processes.

Beneke directed forcible attention to the striking improvement in comparison and even complete recuperation of enfeebled heart action in old valvular lesions, in gout and rheumatism, complicated with heart disease, as the result of judicious employment of the Nauheim springs.[8] In 1882, the Brothers Schott began an exhaustive series of experiments on the effects of immersion in saline solutions on the bloodpressure of lower animals. These experiments together with those of Beneke and Jakob, of Cudowa, place the fact beyond controversy that saline baths exert a marked influence upon the bloodpressure. Further the "resistance movements," which are employed concurrently with the baths, were first introduced and elaborated by the Brothers Schott.

In this connection, too much stress cannot be placed upon the rôle played by the nervous system in bringing about the curative effects of this special method of treatment. Thorne wisely argues that a certain amount of stored energy (available for response to the various stimuli which may be brought to bear on it) is necessary to a successful application of the therapeutic baths and "resistance exercises." It therefore requires an orderly method and sound judgment to decide whether or not the Schott methods are applicable to the

given case, more especially if the patient is suffering from an advanced valvular lesion or myocardial degeneration.

The object of the "resistance exercises," which constitute the second essential portion of the Schott method, is to throw into activity different groups of muscles, more especially those of the extremities, "in orderly succession without inducing fatigue." The movements exert a marked influence upon the circulation, both lesser and systemic. Indeed, they do not belong to the domain of "gymnastics" since they exercise their principal therapeutic effect over the cardiovascular system rather than over the muscular system. There has been considerable controversy over the *rationale* of the "resistance movements." Unquestionably they bring muscles that are for the most part inactive under usual conditions, into normal functional activity; they stimulate the peripheral motor nerves, while the baths, it will be recollected, act upon the sensory nerve filaments and finally they exert a tonic effect on the myocardium. The movements also tend to drive the venous blood to the right side of the heart, by compression of the veins (Broadbent).

This element of the treatment must be carried out by a specially trained operator, who carefully observes certain details in connection with its application. These rules are well summarized by Thorne,[9] as follows:

(1) Each movement is to be performed slowly and evenly, that is, at a uniform rate. (2) No movement is to be repeated twice in succession in the same limb or group of muscles. (3) Each single or combined movement is to be followed by an interval of rest. (4) The movements are not to be allowed to accelerate the patient's breathing, and the operator must watch the face for the slightest indications of *(a)* dilation of the alæ nasi, *(b)* drawing of the corners of the mouth, *(c)* duskiness or pallor of the cheeks and lips, *(d)* yawning, *(e)* sweating and *(f)* palpitation. (5) The appearance of either of the above signs of distress should be the signal for immediately interrupting the movement in process of execution, and for either supporting the limb which is being moved, or allowing it to subside into a state of rest. (6) The patient must be directed to breathe regularly and uninterruptedly, and should he find any difficulty in doing so, he must be instructed to continue counting, in a whisper, during the progress of each movement. (7) No limb or portion of the body of the patient is to be so constricted as to compress the vessels and check the flow of blood.

Every movement is designed to achieve a practical result upon physiologic principles. The patient's condition and endurance must be the criterion as regards the number and character of the movements to be employed. In all cases, therefore, the physician must carefully instruct the operator; not only so, but he should supervise the administration of the "resistance movements" until convinced that they are being properly executed. It is not less important for the medical attendant to note the effects of the movements, for while as a rule the circulatory organs, and to a lesser extent the muscles and the respiration, are strengthened and invigorated, yet an imperative need for a modification of the method may be presented. The movements employed are accurately and individually described by Bezly Thorne and the reader may be referred to his excellent work for further details.

Much in this position might be said to further elucidate the physiologic conditions involved in the more or less coordinate action of the two main elements of the Schott method to wit: saline baths and "resistance movements," but this course would require more lines than these to which the writer is limited. After all it is through its marvellous effects that it makes the strongest appeal to the judgment of an unprejudiced observer. It is well known how unsatisfactorily and incompletely disturbances of compensation in the course of chronic valvular lesions yield to medicinal measures, rest and regulation of the diet at home, both in private and hospital practice; also that almost with certainty progressive myocardial degeneration advances, leading sooner or later to a fatal degree of dilation under similar treatment.

On the other hand, the writer has recently witnessed the application of the method under consideration in chronic valvulitis and various other conditions at Nauheim, and convincing clinical evidence was afforded of its remarkably beneficial and curative effects in a variety of cardiovascular degenerations. Speaking generally, it seemed to him that the improvement, in the vascular changes, as shown by the increased lumen of the vessels and volume of the pulse, was quite as striking as that produced upon the myocardial changes. And the yielding of cases of angina pectoris within a comparatively brief period of time would lend support to the assumption that many examples of this grave disorder are most probably dependent upon abnormal vasomotor influence.

There was, however, brought to my attention clear evidence of

the beneficial effects of the method in vascular degenerations of well-marked degree. The great advantages of the baths and exercises in these cases as well as in myocardial changes, serve to emphasize their potency in stimulating or favorably influencing bodily metabolism. This statement granted, and it becomes needless to point out that the methods are applicable to a wide range of varying conditions other than cardiac.

[The author then recited a few illustrations from among a large number of different forms of cardiac and noncardiac conditions which by the courtesy of Professor T. Schott, he had an opportunity of observing during the bathing course.]

One case was regarded primarily as one of acute dilation; and although complete relief has been accomplished the patient is urged by his attending physician, Professor T. Schott, to return one year hence, meanwhile being allowed to resume his usual vocation.

A case in which it was supposed by the patient's physician, Dr. Sansom, that the severe exercise and excessive use of tobacco had been the cause of the marked disturbance of compensation and induced secondary dilation. It would appear from this and the previous case that the Schott methods are especially serviceable in cases of rapidly developed dilation. In confirmation of this position, I may state that Professor Schott related numerous cases of a similar character.

A case in which Professor T. Schott gave me a remarkable demonstration of the effects of the "resistance exercises" upon the dimensions of the heart. The patient was allowed to rest for forty-five minutes, when mild "resistance movements" were instituted; at the end of seven minutes, the pulse had fallen from eighty-four to seventy-two per minute while both the volume and tension had increased. After eighteen minutes of the exercises, I noted their effect upon the dimensions of the heart. It will be conceded that the movements properly conducted cause a distinctly marked and decided shrinkage in the size of the heart chambers. Obviously, this reduction in size was not maintained, although persistence in the use of the exercises and baths brought about the result stated above.

It is not claimed by the most ardent advocates of the virtues of this method that chronic valvulitis is, as a rule, curable, although a few well-authenticated cases have been recorded. On the other hand, as a means of bringing about compensation either in simple dilation or in that form associated with chronic valvulitis, it possesses advantages which meet the requirements more fully and satisfactorily by far than any other known form of treatment.

It is a point of common knowledge that many patients in whom digitalis has lost its therapeutic influence come to Nauheim and after a few baths this drug again takes hold.

A case in which the combined bath treatment and "resistance exercises" has rejuvenated the patient beyond question. Without stopping to detail other similar cases, it may be stated that in no class of affections did the Schott method appear to exert more salutary effects than in moderate degrees of arteriosclerosis with embarrassment of the heart action. I personally observed several additional instances in which from a course of baths and exercises marked relief was afforded. The explanation is not far to seek; the lumen of the arteries, both larger and smaller, is widened and thus the heart relieved and given an opportunity to rehabilitate itself. Whether the baths and exercises affect principally the vasomotor nervous apparatus or increase the arteriocapillary capacity in an indirect manner by favorably influencing metabolism, I cannot venture to state at present writing.

Closely connected with this class of cases are those in which the atheromatous changes involve especially the coronaries and lead to the development of angina pectoris. It was my good fortune to be privileged to examine several cases of the sort and to note the results of treatment. The special effect of the Schott method was most gratifying and scarcely less than magical in many cases at least.

Granting that the baths and exercises do more good in their own attractive and restful environment than elsewhere, for example at home, it will be conceded that such results as recorded above cannot be attributed solely to this factor.

The writer was also permitted through the courtesy of Professor Schott to note the results of the first thermal bath upon the heart in a case of extreme cardiac dilation.

The manifest shrinkage in the size of the heart following the first bath, however, is not maintained, as holds true also in the case of the "resistance exercises;" each new bath, however, leaves the organ a little smaller than the previous one, and thus compensation is finally restored, in most cases at least. It must be well understood that in the treatment of cases in which chronic dilation less or more is present, the object is not alone to diminish the size of the organ, but to establish a true compensatory hypertrophy. It is to the fulfillment of this end that the Schott methods lend themselves with the most satisfactory results. It is often necessary for the patient to resume the baths from year to year in order to accomplish rehabilitation of the cardiovascular forces.

There is a large class of cases, caused principally by an overstrenuous life especially involving severe mental taxation and characterized clinically by neurasthenia, evidences of malassimilation, indigestion and a moderate degree of dilation of the heart with its usual accompaniments. This group receives striking benefits from a properly regulated bathing course. Great care is necessary in the conduct of this special mode of treatment in this group of cases, since the nervous phenomena are readily aggravated by the irritating effect of the baths on the cutaneous sensory nerves. I was permitted to observe the effects of the Schott method in a number of instances of the sort, all of which were apparently relieved.

Cases of exophthalmic goiter have yielded completely to the treatment and I saw one well-marked case after a cure had been effected.

It would appear from my observation that the primary effect of this method of treatment is to provoke an aggravation of the nervous symptoms in some cases at least and this may readily be carried too far by the unguarded. Within certain limits, however, this stimulation exercises a salutary influence upon the heart's action, the respirations and the systemic circulation of the blood, promoting the warmth of the body and regulating the tissue metabolism to an extraordinary degree. Subsequently, the excitation of the nervous system produced by the baths gradually subsides.

The "after cure" constitutes a not unimportant element of the treatment. The patient is generally sent to an altitude ranging from 1,000 to 3,000 feet above the sea-level, is rigidly isolated from professional, business and domestic cares and responsibilities, and permitted to enjoy an abundance of pure air and sunshine. With reference to altitude, it may be said that the patient's special condition must be carefully considered in reaching a judicious decision. The length of the stay is variable, although on the average about ten days to two weeks.

No presentation of the subject of the Schott methods in the treatment of chronic cardiac diseases would be complete without a brief mention of the contraindications to the treatment: (1) Cases presenting fever. (2) Advanced arteriosclerosis. (3) Far advanced myocarditis. (4) The closing stage of chronic valvulitis, with extreme dilation of the chambers. (5) Aneurysms of the aorta or its larger trunks, except in the incipient stage. (6) In any case in which the bloodpressure is lowered by the balneologic treatment. (7) Cases in which a tenometric figure as low as 65 or 60 mm. of mercury is

found (Schott). (8) Cases in which chronic bronchitis and asthma are well-marked (Baldwin).

Dr. James Tyson, in his paper cited above, has given a full and accurate description of the home-made baths to which the reader is referred for details. Tyson points out the great advisability of more conveniently available baths than those to be found at Bad Nauheim. The writer is in accord with this view, but he is not aware of the existence of specially trained operators to carry out the "resistance exercises"—an essential element of the method.

Moreover, the good effects of a favorable environment and of complete extrication of the patient from business and domestic cares and worriments, are, as a rule, lost when artificial Nauheim baths are attempted. If we take into consideration all these shortcomings and imperfections, there is little need to wonder at the unsatisfactory results, which are only too commonly obtained. To practice the Schott method with success at home demands a separate, well-equipped and properly officered institution and one far removed from the more densely crowded centers of population. Such an institution has yet to be produced.

In concluding, I desire to state that my studies and observations have fully confirmed the correctness of the principles of treatment long since established by the Brothers Schott, and unquestionably to them belongs the merit of having introduced to the medical profession the most efficient method for the treatment of those afflicted with cardiovascular diseases. Great, therefore, is the debt of gratitude which that profession owes to these gentlemen for what is most advanced and most valuable in the sum of our achievement in the treatment of this large group of affections.

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DISCUSSION.

DR. JAMES TYSON: I have had some experience with the Schott treatment, and I would have had more but for the difficulties in carrying it out. It must be admitted that these difficulties are in the way of its application to a large number of cases to which we would like to apply it. I limit myself to the home use of the Nauheim baths, because it is in this connection that we have most of our opportunities, the expense of a trip abroad and treatment at Nauheim being

impossible to the majority of persons. I do not think it is necessary to have a bath establishment. I have used the treatment in private houses, availing myself of the family bath room and tub. It, however, requires a person to conduct the bathing as well as the exercises, although both may be done by the same individual. I have at times had available a man who was very well qualified to aid in the baths, and for a season there was a woman here in Philadelphia who had been trained at Nauheim, but the demand for such services has been so limited that no one has been encouraged to continue this occupation. At present I know of but one person available. The baths may be made very much simpler than the paper by Bezly Thorne would lead us to believe. Sodium chlorid and calcium chlorid are the 2 most important constituents of the Nauheim waters These are present in proportions which can be increased or diminished by the use of water, on the one hand, and concentrated brine, which is the product of the salt manufacturing plants at Nauheim, on the other. Five pounds of sodium chlorid and 5 ounces of calcium chlorid are put into the ordinary bath of about 40 to 50 gallons of water at first. The course consists usually of 21 baths. Three baths are given in succession and then a day is skipped. It, therefore, takes about 24 days to complete a course. The pr-o portions of sodium and calcium are increased until in the last 5 or 6 baths the water contains about 10 pounds of sodium chlorid and 10 ounces of calcium chlorid. The carbonic acid element of the bath is most difficult to imitate at home. At Nauheim this element is present under pressure, and it liberates itself as from the soda fountain as the water is brought into contact with the air. The bubbles come out and fasten themselves on the skin of the patient, making his body almost as white as snow. I have taken a bath at Carlsbad where the carbonic acid is introduced under pressure. The effect is to draw the blood to the surface, relieving venous engorgement At home we cannot secure the carbonic acid under pressure and this element is secured by adding hydrochloric acid and sodium bicarbonate. It is liberated, and commonly rises up around the patient without coming in contact with his body. The carbonic acid is a useful element. It helps by increasing the counterirritation. I do not think it is necessary for me to say anything about the conditions under which the baths are applicable, because this has been covered by Dr. Anders. Suffice it that the cases that receive the most benefit are those of cardiac weakness with dilation, chronic dilation brought about gradually as the loss of compensation is brought about in valvular cases, and also cases in which there has been overmuscular exertion. Acute dilation is best treated by rest in bed and the use of nitroglycerin, etc. But given a case of lost cardiac compensation especially in mitral regurgitation, only partially recovered, the improvement may be extended by the administration of the Nauheim bath, after safe doses of digitalis have lost their effect. Many cases too far advanced to be sent to Nauheim can be treated at home. Less serious cases walk to the tub, but the very advanced should be lifted into it. I have not availed myself of the use of the exercise as possibly I should have done. My method has been to carry on the baths until as much good has been done as possible and then to add the exercises. The baths should not be given in cases of edema and general dropsy. Sometimes the effect is bad in cases in which it is least expected. The patient is a pretty good guide. If he does not feel so well after 3 or 4 baths it is a mistake to continue them. He should be put at

rest. The usua method is to make the first bath 5 minutes in length with the temperature at 95°; the second bath, 6 or 7 minutes, gradually increasing the duration until it is 10 to 15 minutes. Coincidently with the increased duration of the bath the temperature is lowered. At Nauheim the lowest temperature at which they are given is 82° or 85°. In winter the bath should be given in a warm bath room.

DR. JUDSON DALAND: I am greatly indebted to Dr. Anders for calling attention to the fact that, as a rule, the entire heart diminishes in size after the bath and that the right heart is especially influenced by resistance movements. The diagrams which he has shown us which were taken from patients under these two conditions are conclusive, and this cardiac differentiation, as far as the body's resistance movements are concerned, is most practical and important. I agree with Dr. Anders that the good which has been observed at the Nauheim baths is not due to change of climate, and agree with him that the 2 important factors are the baths and the resistance movements. However, I prefer to consider the Nauheim treatment as composite and including the benefits that are derived, not only from the baths, resistance movements and climate, but also to the change of scene, freedom from business and domestic cares and responsibilities, which permits the patient to devote his entire time to treatment. It is evident, therefore, that the very best results are to be secured at Nauheim and that it is impossible to obtain these conditions in Philadelphia with any degree of fidelity. Nevertheless, in these cases in which patients cannot leave their homes, partial benefit will be secured by intelligent use of the baths and resistance movements. Many of the beneficial influences that are to be obtained from these baths may be obtained from ordinary baths, but I am convinced that the addition of the salt and carbonic acid adds to their value. The benefit to be derived from the Nauheim treatment of many cases of weak heart, due to divers causes, has been thoroughly established, but I desire to emphasize the fact that in certain of these cases this form of treatment is injurious and dangerous. This treatment is contraindicated in certain cases of advanced myocardial disease with extreme dilation and also in certain cases of extreme dilation of the heart secondary to arterial sclerosis in association with angina pectoris, where moderate exertion produces a weakening of the tone of the cardiac first sound with irregularity of the heart action

DR. S. SOLIS COHEN: It is nearly 8 years since I had the pleasure of demonstrating before this Society (meeting of January 27, 1897), the Schott gentle resistance movements. In that demonstration I had the efficient aid of Dr. Charlotte West, who had been working with me at that time for about a year, in carrying out the method in my Polyclinic dispensary service. Besides Dr. West I trained a number of massage operators, male and female, in these methods, and there are 4 persons now in Philadelphia competent to carry the treatment out, whose addresses I shall be glad to give to those interested. There is also in this city a branch of the Battle Creek sanitarium under the care of Dr. Knapp and his wife, who is also a physician. Mrs. Knapp can give the Schott resistance movements and they have, at my suggestion, trained some of their assistants. They are also prepared to give the Nauheim baths. Dr. J. K. Mitchell, who wrote the article on the Schott resistance movements in my "System of

Physiologic Therapeutics," has likewise trained a few operators. There is, therefore, no difficulty at all in using the treatment in Philadelphia and I have so been using it these 8 or 9 years. The baths can readily be given at home if the patient is willing to take a little trouble, and if the physician is willing to give a little of his own time to get them properly started, after which intelligent patients or assistants can be trusted with the details. The Triton Salt Company and Mr H. A. Cassebeer, of New York, furnish packages containing acid sodium sulphate in cakes and sodium carbonate in bags of the proper quantity (32 ounces each) to produce the carbon dioxid of an ordinary gaseous bath. Greater quantities can be prescribed if desired. The commercial packages are very convenient to begin with in private houses. With hydrochloric acid there is the danger of injuring the bath tub unless it is porcelain. To get a good evolution of gas it is necessary to have the acid sulphate and the sodium bicarbonate in good contact. I learned the best method from a patient. Fill the bath tub half full of hot water, about 20 gallons. Put in the sodium chlorid and calcium chlorid to make the brine and add the sodium bicarbonate. Let this solution remain for about twenty minutes so that the salts (brine and alkaline) are thoroughly disseminated throughout the whole mass of water. Then add 20 gallons more of water sufficiently hot to bring up the temperature of the whole mass to 95° F. or less as desired. Now put in the acid sulphate cakes, each upon its own layer of tin foil and distributed at proper distances. Wait a few minutes more for thorough effervescence. The bath is now ready for use. In treating patients at home, I have found it advisable to modify the Schott methods somewhat. As has been pointed out, the conditions at home are different in so many respects from those abroad that what is best under one set of circumstances is not always best under the other. It is much better when the patient can go abroad, to send him to Nauheim, because, in addition to rest and other factors mentioned, there is a highly important element obtainable there which one cannot get anywhere else in the world—the personality of Dr. Schott. This is a very large factor in the cure of many patients. His scientific spirit, his authoritative manner, his thorough mastery of the subject, his admirably organized routine and the absolute obedience that he gets from patients and attendants count for a good deal. Still, we can do some things at home. The manner in which I have found it advisable to give the baths is in a course of 6, 8 or 12 weeks, interrupting them for 8 or 10 or 12 weeks and then repeating them for 2 or 3 weeks; then again interrupting and again repeating at such intervals as seem best in the individual case. The best time to give the bath in many cases is at night, so that the patient can get several hours of continuous rest after it. The bed should be warmed so that there shall be no sudden change of temperature. I give the baths, not for 3 days in succession, but every other day or every third day, giving the exercises on the alternate days, if exercise is to be given. Sometimes the baths can be followed by massage, the character of which will vary with the character of the lesion and reaction of the patient. All these details must be individualized very carefully After one has acquired a little experience he learns easily

how to manage the details and both the patient's sensations and the objective results are most valuable aids in such modifications. I am able to confirm what Dr. Anders has said of the value of the method in some instances of exophthalmic goiter. There is also considerable danger in its employment in exophthalmic goiter. In the selected cases it will do good if carefully applied and applied by the physician himself. While I would trust a patient to take the baths or trust a trained person to give the exercises according to prescription in an ordinary case of chronic cardiac disease in which no urgent symptoms were present, I would not trust either patient or attendant in a case of exophthalmic goiter. I should want to see the effects as the treatment was in progress. An aggravation of the nervous condition can readily be brought about—as by giving the bath too hot, too cold or with too much carbon dioxid. I cannot agree with Dr. Daland that the addition of the brine is unimportant. I have made many control observations and I find that it is necessary. My ordinary course indeed is to give 2 or 3 preliminary baths with tap water at varied temperatures, noting the results. One can then begin with a weak brine, say at the fourth bath, 4 pounds of sodium chlorid and 4 ounces of calcium chlorid to 40 gallons of water. The association of fours makes it easy to remember. Ordinarily, at every second bath we increase 2 pounds of sodium chlorid and 2 ounces of calcium chlorid; for instance, at the sixth bath we give 6 pounds of one and 6 ounces of the other; at the eighth bath, 8 pounds and 8 ounces; at the tenth bath, 10 pounds and 10 ounces, and so on up to the twelfth or the fourteenth bath, when I usually cease to strengthen the brine. At about the sixth bath we can begin the addition of carbon dioxid by having the patient use half the quantity of the sodium bicarbonate (*i. e.*, using 16 ounces) and halving the acid cakes, but preserving the number furnished—there are usually 8 of 4 ounces each. At the eighth or tenth bath the patient uses the full quantity, and this may be maintained or increased according to results. At the end of the twenty-fourth bath we may have doubled the amount of carbon dioxid, using 4 pounds each of sodium bicarbonate and acid sodium sulphate. This is perfectly safe if we approach it in some such graded way, extending the treatment over a sufficient number of weeks. I may add that the quantity of sodium bicarbonate necessary to neutralize the acid sulphate is only 8 parts to 12, but by keeping the alkali in excess we avoid any risk of having free sulphuric acid in the bath. The patient should go to bed and rest for the whole night. He should receive exercise on alternate days instead of on the same days as the baths, and do everything very gradually, being satisfied to make progress slowly. I have seen some results so remarkable that I have hesitated to report them, lest I might be thought to be overenthusiastic. When I made my first report on the exercises and Dr. West gave the demonstration alluded to, in January, 1897, you may remember that one patient exhibited was an old woman who had been treated at the Philadelphia Polyclinic. She had a mitral lesion—I've forgotten just what, probably stenosis and regurgitation—and also moderately advanced arteriosclerosis. The symptomatic improvement was quite remarkable. In cases of arteriosclerosis, if not too far advanced,

I have seen many good results; also in angina pectoris, in mitral stenosis and in mitral regurgitation. It is in mitral stenosis that the most brilliant results are obtained. The method is not advisable in aortic lesions, as a rule. It is of high value in functional heart disease, especially neurasthenia, and in vasomotor disturbances. In one case of greatly disturbed action of the heart from residence in Colorado, the patient was able to return to his mountain home, where the treatment is continued by his local physician from time to time and he has remained well for 2 years. The counterindications have been spoken of. I differ from Dr. Daland concerning the resemblance between the effect of active exercise on the part of the patient and the gentle resistance movements of the Schott system. In the Schott system there is no muscular effort—using that word in the meaning of concentrated exertion—on the part of the patient. The moment he begins to make such an effort he defeats the object of the treatment. It is exercise not simply against resistance, it is against *gentle* resistance. As Dr. Anders has illustrated, the operator simply rests his hand lightly upon the limb or trunk of the patient, avoiding pressure and the patient moves the part very slowly, very gently, using just enough exertion to overcome the very gentle resistance of the operator. The operator supports the limb during the pauses between the up and down, or other reciprocating movements. The fact that the movements are interrupted if the patient shows any change of color, if he perspires or dilates the nostrils or gives any indication of respiratory or other effort or distress of any kind, demonstrates that the whole object is not to make the patient take exercise from a muscular viewpoint, but to bring gentle traction by means of the feeblest contractions of the muscles upon his vessels. Thus the benefit of the exercises is in the starting up of the peripheral muscular pump upon the vessels so that the action upon the vessels of the ordinary contractions of the muscles continues to assist the work of the heart. The object of the bath is likewise to assist peripheral circulation. The bombardment of the skin by innumerable bubbles of carbon dioxid, assisting the action of moderate heat and the chemical stimulus of the brine, gives to the skin heart a much more active stimulation than we could get from massage or electricity, or mechanical vibration manual or instrumental, though the principle is just the same, the diversion of the blood to the surface and the stimulation of the vasomotor reaction-tonus.

DR. P. S. DONNELLAN: Two years ago, I made a careful study of the treatment of cardiac diseases at Nauheim through the courtesy of Dr. Schott and concluded that, carried out in all its details with the environment of Nauheim, it was an admirable and rational therapeutic measure in selected cases. The Schott method of treatment, as Dr. Anders has stated, is a combination of medicinal baths and drinking waters, resisting exercises and care in diet, all of which, in the perfect environment of Nauheim, contribute to the success of the treatment. In my opinion, too much stress is laid on the importance of the baths *per se*. They are, after all, but one feature of the treatment. I think great care should be used in the selection of cases sent to Nauheim for treatment. I saw a number of patients there who had come a long distance and in whom the treatment was distinctly harmful. Suitable cases of cardiac dilation, early arterio-

sclerosis and slight valvular lesions with unbroken compensation, gave the best results. The resistance exercises, given under careful medical supervision, by a competent operator, I consider a very valuable addition to the Nauheim treatment. I was greatly impressed with the attention paid to details in the Nauheim treatment. When a patient arrived at Nauheim after registering at a Kur Direction, he was given a list of reliable physicians, one of whom he selected for his medical attendant. After a careful examination, the doctor wrote on a card the most minute directions regarding the baths and exercises. He saw the patient every third day and, after reexamining him, he modified the details of the treatment to suit the patient's condition. The baths and exercises were most carefully given by male and female attendants. The baths were made of cedar wood to resist the action of the brine and were sunk in the floor of the bath room at a level with the floor, which obviated the necessity of a feeble patient having to climb into the tub. The after cure is of considerable importance, the patients, after a 6 weeks' course at Nauheim, being sent to the Black Forest or to Switzerland for that purpose.

DR. WILLIAM S. WADSWORTH: It would be hard to find a treatment more clearly based on physiologic principles and demanding physiologic knowledge in its application, and I, therefore, presume to call your attention to certain matters of physiologic import that have not been mentioned this evening. Many of the cases that present themselves for this treatment are evidently due to a sluggishness or stasis of part or whole of the organism; many have become, through fear of the effects of action, more sluggish. This stasis is part physiologic and must be accurately estimated, and such an estimate will constitute a physiologic diagnosis. That the treatment may reach these physiologic conditions we must have a knowledge of its physiologic value as a whole and of each factor. The effect of the treatment is due to mechanical and chemical actions and mechanical, chemical and vital effects. The bath offers a mechanical support for the body so different from that of the ordinary positions that the relief offered is a factor of considerable moment. The bodily compression in the bath is a very great factor in changing the circulation when the vasomotor mechanism is working at a low tension. The specific gravity of the bath as changed by the added salts affects these effects materially. The mere soaking of skin in water or any solution has an effect easily proven by placing one hand in a basin of water for a half hour and then studying the difference of skin condition, as to sensitiveness, circulation and maceration, of the two hands. This effect is materially changed if we have the skin oiled, as in nature in certain cases, when a soap and alcohol bath might be necessary as a part of the preliminary treatment. Also the effect will be materially changed if we add chemicals. But equally important are the reaction phenomena that occur on the drying out of the skin after soaking. The effect of temperature has already been brought to your attention. The chemical and mechanical action of the salts and gas have been discussed. The effects of exercise are so many and complicated that it is very hard to confine oneself to a mere mention of topics each of which opens up a vista most interesting and important. The motions used in the treatment are in no sense passive. They are active in every sense. They are gradually performed and should be gently begun, though not infrequently should become intense. The stasis that results from inaction effects tends to cause shrinkage

and contraction on one side and weakness on the other. If passive motions alone were used we would simply stretch and weaken the tissues, but by active motions we stretch and strengthen them. In the exercises we have these effects: stretching of the nerves, muscles and vessels; compression of nerves, muscles and vessels, with displacement of lymph and corpuscles in and about the tissues that have become stale, the internal nutrition and respiration of the tissues being thus increased. The determination of blood to the muscles after the blanching of contraction is positive, the compression of the vessels by the next contraction of the muscle causes a freer flow which overcomes stasis of the vessels and relieves the heart of some of its labor. The chemical changes resulting from action produce a reduction of certain substances in the blood, thus relieving a chemical blood stasis which is frequently a serious factor in disease and the production of fatigue substances which are normal physiologic stimuli to the heart and other organs which must be reckoned with as of the greatest importance in all heart cases. A third great group of phenomena to be observed as the result of the action of these chemical and mechanical factors that we characterize as vital, resulting from their action on the living cells of the various tissues and appearing as primary and secondary reactions. These phenomena are the real factors of health, for the study of which we have not yet a proper name, so for the present we have to study them with the mechanical and chemical phenomena that are so very much more easy to comprehend. They must be grasped, however, before we will be able to fully discuss this treatment.

DR. JOHN MADISON TAYLOR: The Nauheim treatment is a complicated proceeding developed through years of experience, and can only be carried successfully by those who have studied the measures on the ground, at first hand. Personally, I have never been to Nauheim, but have paid much attention to the treatment and had correspondence with Dr. Credel about a number of patients. The physicians of Nauheim claim that the treatment is not the property of the Schott Brothers. I am convinced that the best effects can only be obtained through the combination of saline baths, the personal attention of experienced physicians and attendants, and the climatic and other conditions obtained at Nauheim. It is impossible for us to justly criticise the measures without actual experience. The element of the exercises interests me particularly and I think them excellent, only they are monotonous. If the time permitted I should like to relate my own experiences in similar states using a larger variety of carefully outlined movements, from which I have had admirable results. Here is a field which the American physician should study with care. It is not to be expected that with partial knowledge in this direction and through the employment of unskillful persons, to secure the good results which are readily obtainable by these measures. In the majority of the cardiac disorders the treatment should be performed while the patient is lying down, as I pointed out in a paper I read before the Climatological Society. The principle on which this should be carried out is always accurate slow movements from full relaxation to full tension, allowing full periods of rest to intervene, in proportion to the degree of rest required. This treatment should be applied by the physician himself, and will not occupy more time than an ordinary professional visit, when also the necessary accurate observations can be taken and records made. This treatment will tend to quiet the heart that is hurried, and it will last for some time, and when systematically

repeated brings down the erring heart to normal rhythm, at the same time regulating other symptoms without the aid of medicines. Nothing exerts such an excellent effect upon venous stasis and lymph stasis as the use of passive and active movements, stretchings and respiratory training. I am prepared to express the opinion that we can secure effects upon surface circulation similar to those caused by the baths at Nauheim by other means. Again, by a faithful study of individual needs and a scientific and practical acquaintance with the application of regulated movements and hydrotherapy it is entirely possible to parallel the results obtained by these excellent physicians at Nauheim.

DR. ANDERS: I did not place much stress upon the homemade baths because prior to this evening I was rather skeptical of their value in the treatment of chronic cardiac disease. I have not been convinced from what I have heard this evening that we are in a position to carry forward this treatment successfully at home. When I compare the results in this country with those obtained at Nauheim I am still further convinced that we are not prepared to carry on the Schott methods successfully. There is no class of cases in which it is so necessary to consider the patient himself the principal factor rather than the disease from which he is suffering, as in this large group of cardiovascular diseases. There is no stereotyped method of applying this treatment. They usually begin with the milder bath which is gradually increased in strength and duration, yet the details vary greatly with different cases. At home we cannot, as Dr. Tyson well said, introduce the carbon dioxid under pressure as there. Prof. Schott attaches much importance to this element of the bath. There is a marked stimulation of the skin causing first a pallor and then a distinct redness of the body while the patient is in the bath. To have a suitable establishment in this country would require the services of some one who is a specialist in heart diseases and their treatment according to this method; one who could see the patient daily and watch the effect of every bath and every application of the resistance movements.

SYMPOSIUM ON FOOD ADULTERATION AND PRESERVATION.

[December 28, 1904.]

Food Preservatives and Food Adulteration.

BY H. W. WILEY, M. D., Chief of the Bureau of Chemistry of the United States Department of Agriculture.

This, perhaps, is a hackneyed subject which you ask me to speak to you about tonight, and yet one of continued interest, not only to the physician, but also to the people themselves.

That food must be preserved is a fact recognized by every one. Only in a savage state is it necessary to eat food as it is secured, to live

practically from hand to mouth; but in all civilized countries there is a laying up of stores of foods against the seasons when foods are not produced, and thus, the necessity for preserving food in some way has been recognized since man emerged from the savage state.

The subject of the preservation of food by modern methods did not assume great importance until a half or a quarter of a century ago. The development of the science of chemistry placed in the hands of the manufacturer the means before unknown of preserving food, and the means of matching in manufactured foods natural tints and colors, all made possible by the development of tinctorial chemistry, on the one hand, and of synthetic chemistry, on the other.

We have many food preservatives which have been in use since the earliest times, the usual condimental preservatives and substances which reveal themselves to the consumers by their odor and taste, such as common salt, sugar, vinegar and wood smoke. Their established use is well recognized and no legislation has forbidden the use of such preservatives. There is another class of preservatives, known as antiseptics; and in the quantities in which they are used they have neither taste nor odor, so that their presence is unknown to the consumer, unless stated to him.

I believe the fight against artificial coloring matters is almost won, and that the education of the public in regard to artificial colors is quite as effective in this direction as any legislation that can be enacted. The moment the people demand uncolored foods, that moment they will get them. It has been claimed that the use of colors in foods is not reprehensible so long as the colors are harmless to health. From the medical point of view I assent to that proposition. There is, however, a vice in the use of colors more insidious than the effect upon health, the vice of deception in food products. Why should a food product be made to assume a character which it does not naturally possess in respect to color? The manufacturer, who should be heard, says that the people demand that the food shall have these colors. They probably do at the present time, but they certainly did not at the beginning. The taste which now rules the public is one which has been created by the use of these coloring matters and, therefore, the public cannot be held responsible for that taste; and, more than that, the public is certain to demand the uncolored article just as soon as they are informed in regard to the nature of these coloring matters. I refer especially to articles injurious to health rather than to that class which it is claimed have no effect of an injurious

character upon the health of the consumer. I believe manufacturers agree that the use of mineral matters in foods is reprehensible. Candy manufacturers boldly proclaim this and are trying to have the use of mineral colors of any description prohibited. That is perhaps a pretty sweeping condemnation, but we do know, for instance, that lead chromate and copper sulphate are not regarded by the medical profession as particularly wholesome articles of food. Copper sulphate is used because of its property of intensifying and fixing in the tissues the natural green color. The color of peas and beans fades after a certain time, even though kept in the dark.

The manufacturer should have a fair inning, and he claims that on the addition of copper sulphate to the foods it enters into a chemical combination in which the copper salt becomes inert and insoluble in the digestive juices. I am not inclined to accept that as a logical argument. I have not, however, myself made any experiments looking to the determination of the effect of copper sulphate upon health and upon digestion, but am dependent upon data collected by other people. In a court of justice the accused is held to be innocent until proven guilty. Here, however, is a criminal, confessed to be guilty by everybody. Even the manufacturer will admit that copper sulphate in itself and uncombined in a food product is a harmful agent and, therefore, it should be held to be harmful until proven innocent.

As in many other cases, experts disagree in this. I am not speaking of the character of the expert. I believe that an expert has the same right to advance the interests of his client that an attorney has, provided he does no violence to his conscience and to science. He has the right to make out the best case he can, preserving, always, his integrity. You all know that experts can take the same data and viewing them from different standpoints, draw conclusions diametrically opposite, and do it reasonably and perhaps logically. Especially has this been true in France, where there was formerly a law prohibiting the use of copper sulphate in food products. The French Committee on Hygiene was convinced after further study that this law was not applicable. It was repealed and as a result we get large quantities of food products from France containing copper in varying quantities. But the real effect of copper sulphate was not altered by this change of opinion. In considering questions of this kind, if we had the results of experiments with copper sulphate such as we have with borax we would have some additional sound and conclusive evidence. In the absence of such data, and in the presence of the conflicting opinions

of experts the best thing to do is to be guided by the general principle that a substance known in itself to be injurious to health is guilty until proven innocent. All we have done in executing our food law so far is not to send the guilty party to jail but to ask that the supposed criminal be labelled so that all may be warned of his character. We hope sometime to be able to settle this question by definite experimental evidence, but meanwhile we are content with publicity. I believe we can do more in many cases by moral suasion than by the strong arm of the law. During almost two years of the execution of our food law we have never had a case in court and yet we have secured what we have wanted. After the second of February we shall require that all food products entering this country artificially colored shall bear a label so stating, without asking in any case that the material for coloring be declared, except in the one case of the copper sulphate, which is not solely a coloring matter, but also a mordant.

I want to elucidate the position which I have occupied upon the almost universal coloring of butter. I have for many years opposed that practice, and I attended a convention some time ago in this city in which I took, as it were, my life in my hands upon this question. I am glad to report to this assembly that there is today a growing tendency among the farmers to believe that uncolored butter is better and will bring a higher price in this and other countries. The moment the dairymen understand this there will be no more difficulty about coloring butter. The farther south you go the deeper the people want the color of the butter. I don't know why a high temperature and a desire for high color in butter go together, but it is a fact. Demand that the butter you eat shall be uncolored, and in two or three years, without trial by jury, you will get what you want. I was in a convention recently in Detroit, when one of the largest manufacturers said to me that they had joined me in my crusade against color, and that after the first of January their factory would make no more artificially colored food products. I do not believe it is a good thing for us to eat continuously even a small quantity of colors though they may be regarded as harmless. They are not foods, are not, as a rule, digestible, and have generally no relation to the chlorophyl and its derivatives which form the natural coloring matter of vegetable life. We know that there is a certain amount of indigestible matter in food which is necessary to health but Nature provides this in the foods. The idea which I formerly held to tenaciously, viz., that the coloring of foods by harmless matters

made them more attractive and, therefore, more digestible, I no longer hold. My advice to food makers is to stop using colors as soon as they can and especially if the coloring is under suspicion of any kind.

Concerning antiseptics in relation to foods, I think the rights of the consumer are paramount. My position is that there should never be an antiseptic, save those already enumerated, admitted to foods, except in case of absolute necessity, unless the consumer orders it for himself. I believe anybody has a right to eat anything he pleases, but that he has no right to make another person eat the same thing. Antiseptics should not be used in food products except when ordered by the consumer, or when the foods are made for specific purposes and when they cannot be safely preserved by ordinary means until they are used and where such preservative is absolutely necessary in long journeys and in remote localities. It is far better to eat foods with antiseptics in them than to have no food at all. I am in sympathy with the campaign of education and believe that when preservatives are placed in foods the consumer should be notified; also that he ought to have the opportunity to get foods without them when he wants to. I believe many of the great food manufacturers are already excluding many of the antiseptics. At first when labelling was suggested the manufacturers said the people would not eat the correctly labelled foods. This brought them to the proposition that it was right to deceive the consumer or to injure him. I do not believe it is right to deceive a consumer or to injure his physical health. Neither should violence be done to a man's moral health. One of the men interested in the making of foods stood up before a committee of Congress and claimed that deception was the life of trade in foods and that the very moment you stopped deception you ruined trade.

Our experiments have convinced us that antiseptics in foods are injurious and unnecessary. Our methods of experimenting may be wrong, but they will all be published with the data and not a single fact observed has been left out. Our conclusions show that the use of these substances in food products is deleterious to health and they should be excluded on that ground. If I had any view at all concerning borax it was that it was the least harmful of all substances used in food. Well, if it is, the others are pretty bad. We showed conclusively that borax, in quantities not exceeding half a gram a day and extending over a period of fifty or sixty days, was distinctly deleterious to health, and used in large quantities it speedily put the subject out

of the fight. We didn't get quite the results that our German friends did. Neither did we get those of the experts on the other side of the question employed by their clients to show that borax is harmless. The strength of our ground is that we had no client. We were not employed to do anything, except to make studies upon the effects of borax. We were not studying borax from the standpoint of the manufacturer. We were trying to enlighten the public and bring about a state of affairs radically different from that in the past. We have had a most sympathetic body of advisers in the medical profession, and I believe that through the medical profession the public will be taught the true principles of nutrition in this respect.

Sulphurous acid is found largely in foods, especially in desiccated fruits which are subjected to the fumes of burning sulphur to retain their color. It is also used to preserve wine and is produced by burning sulphur in the casks. I do not know of any way of preserving the natural color of dried fruits, except by fumigation with sulphurous acid. Whether that is justifiable or not I am not here to say, but it is a practice which appears to be universal, and the same is true of the burning of the sulphur match in the barrel in winemaking; a practice which has come down from antiquity. But when sulphur is employed as at the present time in an enormous excess for preserving a poor wine and putting on the market a new wine before it has ripened it is unpardonable. In this connection we are having a battle royal with our French brethren. To pay them a high compliment we adopted some time ago their standard for the use of sulphurous acid in wines, and as soon as we adopted it they objected to their own standard and appointed a new commission which raised their standard to just double. They then appealed to us to adopt their new standard, and I suppose if we did they would make another double on us in the use of sulphurous acid. In the case of importing food products we have a great advantage over those who execute the laws of a State, because they are compelled to go to the courts, while we are a law unto ourselves. We hope so to conduct the execution of this law that we will secure not the opposition but the support of the importers. We are improving the character of your wines by keeping out those in which sulphurous acid is used in excess. We are improving the character of your Frankforter sausage by requiring Germany to send us such as they are willing to eat at home. Our law happily says that any food product not allowed to be sold in the country in which it is made shall not be

allowed to come to the United States. On that ground we have sent back several cargoes of German sausage containing borax, and on arriving at the German frontier they are inspected and rejected, and like the "Flying Dutchman," are still sailing over the sea, seeking a port, a haven of rest.

I believe the application of the principle of honesty would be the best food law that could be enacted. If I were to write a food law in one sentence it would be; "No injury to health: no deception."

Defects in Pennsylvania Food Legislation.

BY WILLIAM W. SMITHERS, ESQ., of the Philadelphia Bar.

By way of preface let me say that I favor proper laws for preventing both the manufacture and the sale of food stuffs that are either unwholesome or falsely or inadequately labelled. This paper is intended to show that the laws upon this subject now being enforced in Pennsylvania are not proper legislative expressions of the sovereign will of the people, and result in unjust and unnecessary interference with manufacturers and merchants.

Legislation for regulating the preparation and sale of articles of food and drink is not new. The ancient Greeks had laws to control the sale of olive oil and the Romans regulated commerce in many agricultural products, notably the grape.

Under the early common law of England it was an indictable offence to sell a commodity in which an unwholesome ingredient had been mixed. Indeed the statute of 51 Henry III, passed in 1266 by the assembly that fixed the bases for the subsequent House of Commons, prohibited the sale of corrupt wine and unwholesome flesh. In 1814 an English court refused a new trial to a man who had been convicted of selling bread not fit for food in that it contained alum (Rex *vs.* Dixon, 3 Maule & Selwyn, 11).

England finally passed what is known as the Food and Drug Act, on August 11, 1875 (38 and 39 Vict., c. 63), thereby first bringing into concrete form the many fragmentary acts and administrative regulations theretofore promulgated by several European governments. Up to that time our own country had but few food laws, two or three States, only, having passed acts touching some particular product without attempting to embrace the whole

subject. Pennsylvania had section 69 of the Act of March 31, 1860 (P. L. 401), which was merely declarative of the Common Law as to selling any unwholesome food or drink, and also the Act of April 14, 1863 (P. L. 389), prohibiting the use of deleterious drugs in liquors, but both were based upon the misdemeanor being done knowingly.

Probably aroused by the passage of the English Act of 1875, our National Board of Trade offered a prize for the best essay upon food and drug adulteration which should include the draft of an act "designed to prevent injurious adulteration and to regulate the sale of food without imposing unnecessary burdens upon commerce." On October 27, 1880, the prize offered was awarded to Mr. George W. Wigner, an English scientist, and the essay was published in January, 1881, in "The Analyst." This marked the inauguration of a pure food agitation which has grown with such startling rapidity that one is forced to suspect its inherent merits. Especially does it seem astonishing when an examination of statistics reveals the fact that adulteration does not affect five per cent. of the food consumed. It cannot be doubted, however, in the light of subsequent events, that a new school, issue or "ism" was born in 1881, and that its propagandists have so spread their teachings throughout the country that most legislative bodies will now pass, as they have already done in some instances, measures plainly senseless, unjust or impracticable because entitled "A Pure Food Law."

Within three years after the publication of Mr. Wigner's essay, a National Pure Food Bill was offered in Congress and half a score of States had passed far-reaching, and in some instances absurd, laws upon the subject.

The draft of the act submitted by the essayist was at once adopted, almost *todidem verbis*, by the Legislature of New Jersey. Shortly thereafter Illinois, New York and Ohio followed with varied elaborations of the writer's recommendations and definitions. There are now but six of all the States and Territories without general food laws and complete departmental organizations for their enforcement. It is true that these provisions yield some degree of benefit to the people at large, but at the same time they are to a greater extent undeniably made instruments of private gain, political power, individual oppression and unwarranted interference with trade. It is safe to say that Mr. Wigner never dreamed himself the fountain of wisdom his followers would have us believe, nor could he ever have been convinced that his modest essay was capable of so much false interpretation.

Our own State was particularly susceptible to this new crusade, because of unusual political conditions and the need by the party in power of support from the agricultural interests.

Prior to this time there had existed a private association known as the State Board of Agriculture which had been largely assisted by the State, having been established by an act of the General Assembly approved May 8, 1876 (P. L. 129). This body procured the passage of the Act of May 25, 1878 (P. L. 144), to prevent the sale of adulterated milk, the Acts of May 22, 1878 (P. L. 87), and May 24, 1883 (P. L. 43), "to prevent deception in sales of butter and cheese," and the Act of May 21, 1885 (P. L. 22), called the Dairy Products Act, entitled "An Act for the protection of the public health, and to prevent the adulteration of dairy products and fraud in the sale thereof." Then followed the Acts of May 23, 1887 (P. L. 157), "to prevent adulteration of candy or confectionery;" June 8, 1891 (P. L. 213), to regulate the sale of lard; June 11, 1891 (P. L. 297), to prevent the adulteration and regulating the manufacture of vinegar, and May 23, 1893 (P. L. 112), prohibiting the use of imitation dairy products in public institutions. The Act of May 26, 1893 (P. L. 152), was then passed to enlarge the powers of the State Board of Agriculture and authorized *that Board* to appoint an agent, to be known as "Dairy and Food Commissioner," to enforce the Act of 1885. By section 4 it provided: "That the said agent of the State Board of Agriculture and such assistants, agents, experts, chemists, detectives and counsel as he shall duly authorize for the purpose, shall have full access, egress and ingress to all places of business, factories, farms, buildings, carriages, cars, vessels and cans used in the manufacture, transportation and sale of any dairy products or of any adulteration or imitation thereof."

The next step shows that the directors of the dominant political party were not blind to the possibilities of such a popular shibboleth as "protection to public health." Thus the Act of March 13, 1895 (P. L. 17), was passed establishing a Department of Agriculture, "to be organized and administered" by an officer to be known as Secretary of Agriculture, and creating the office of "Dairy and Food Commissioner" as the head of a bureau of that department. The act is still in force and provides that the Dairy and Food Commissioner shall exercise all the powers given to the agent of the State Board of Agriculture by the Act of May 25, 1893, before referred to, and also the other powers conferred upon his chief by the third section, which reads

as follows: "The said Secretary shall also be and hereby is charged with the administration of all laws designed to prevent fraud or adulteration in the preparation, manufacture or sale of articles of food, the *inspection*, sale or transportation of agricultural products and imitations thereof and all laws relating to diseases of domestic animals and to the manufacture and inspection of commercial fertilizers."

It is quite plain that the powers formerly exercised by the agent of the Board of Agriculture were thus enlarged to embrace all food stuffs and that a new Department of the State government was created for carrying them out. All of our State Food Commissioners have held office pursuant to this Act of 1895 and the present one derives his official title, compensation and most of his powers therefrom.

This act, by thus combining all the essential features of the Acts of 1885 and 1893 into a definite system, and placing its administration in the hands of a new officer, was a clear violation of the following clause of the Constitution of 1874: (Article III, Section 27) "No State office shall be continued or created for the inspection or measuring of any merchandise, manufactures or commodity, but any county or municipality may appoint such officers, when authorized by law."

The present office of Dairy and Food Commissioner was certainly created by the Legislature as shown by the acts mentioned. The incumbent is appointed by the Governor and is paid by the State. He is, therefore, a State officer appointed to perform the duties of a State office and as such is charged with the *inspection* of merchandise, manufactures and commodities so distinctly prohibited by the Constitution.

This conclusion is upheld by the legislative history of our State and by definite judicial declarations. The first act introducing systematic inspection of merchandise was that of April 15, 1835 (P. L. 393), which provided for the appointment, duties and powers of inspectors of various kinds of commodities throughout the State. In principle and in methods of enforcement that act upon examination will be found to largely correspond with the system established by the Act of 1895. Under the old act the most pronounced evils were the annoyance to merchants and the opportunities for favoritism and blackmail. So vicious had these abuses become that the delegates to the convention called to frame the Constitution of 1874 determined to make such a system forever impossible in the future. After several clauses had been considered and rejected (Constitutional Debates, Vol. II, pages 709, 727; Vol. VII, pages 335, 401) the following was submitted:

"No State office shall be continued or created for the inspection or measurement of any merchandise, manufacture or commodity, *except for the purpose of protection to the public safety;* but any county or municipality may appoint such officers when authorized by law" (Debates, Vol. VII, page 417).

After discussion, the words "except for the purpose of protection to the public safety" were stricken out and the section as it now stands in our Constitution was adopted, thus showing that it was meant to prohibit such State inspectors, no matter for what purpose appointed. Some extracts taken from speeches made before the Convention when this subject was being considered will show some of the evils sought to be eradicated.

Mr. Franklin B. Gowen said: "There is no more tyrannical exercise of power than the appointment of these petty officers. Every professed politician, who cannot get an office in any other way, goes to Harrisburg and endeavors to get his friends to appoint him an inspector of some commodity of known general use. . . . Do not let us adopt any proviso which, upon an assumed regard for the public health or the public safety, will enable the Legislature to infest the community with those people" (Debates, Vol. II, page 713).

Mr. J. Price Wetherill said: "Now, sir, what is the condition of things at the present time? In this city we have placed upon us by the Legislature at Harrisburg certain inspectors of merchandise, and I say in my place that the majority of them know nothing whatever about the articles they inspect. . . . The whole thing is a farce and a fraud, and for that reason I hope this section will be retained. It is not exactly what we ought to secure, but it does remove the appointment of these officers from the Legislature and places them under the different municipalities throughout the State, thereby bringing the appointing power nearer to the merchants and manufacturers who suffer from the system, and thus they can more readily secure justice at the hands of their own municipal authorities than at the hands of the State authorities, the State Legislature knowing little and caring less about such matters" (Debates, Vol. VII, page 400).

That the Act of 1895 makes possible the very abuses which our fundamental lawmakers intended to abolish and did prohibit in the plainest and strongest terms clearly appears by a positive legislative declaration. By the Act of February 24, 1897 (P. L. 524), a committee of the House and Senate was directed to be appointed to

investigate certain charges against "and the management generally of the working of the office of Dairy and Food Commissioner." The charges referred to appear in the preamble of the act, as follows:

"*Whereas*, It is alleged that the Dairy and Food Commissioner of the Commonwealth and officers under him are not discharging their duties with fidelity to the citizens of the Commonwealth.

"*Whereas*, It is alleged that certain dealers in oleomargarine in the city of Pittsburg pay to officers, agents or others for said department, one cent per pound upon all oleomargarine they are permitted to sell in violation of the 'Oleomargarine Act' and that those paying said sum are shielded and protected from prosecution.

"*And Whereas*, It is alleged that other irregularities exist in said department."

Without attempting to explain why the public never heard much of the investigating committee's work, attention is called to this act as justifying the arguments used by the gentlemen of the Constitutional Convention.

The deduction that the Act of 1895 contravenes the Constitution has received in addition to the foregoing historical confirmation, actual judicial sanction. While the Supreme Court has never considered the question the following county court cases fully sustain the view expressed: Commonwealth *vs.* McKeesport Company, 11 Dist. Rep. 215, and Commonwealth *vs.* Houseman, 11 Dist. Rep. 480. The same ruling was made in Alabama in State *vs.* McGough, 118 Ala. 159, under a constitutional provision identical with our own, word for word, the highest court declaring that no such office could be created and that any act having such effect was clearly unconstitutional.

The law of 1895 creating the new office, however, was apparently but the first step in the plan seemingly arranged to make places for the faithful despite the constitutional prohibition. After allowing three months to elapse,—justifying the declaration, sometimes erroneously attributed to Chief Justice Gibson, that "no man's life, liberty or property are safe while the Legislature is in session" (Anon. 1 Tuck. N. Y. 247),—the Act of June 26, 1895 (P. L. 317), was passed and heralded as the great "Pure Food Act." It specifically commands the Dairy and Food Commissioner to send out agents to perform every act necessary for the inspection of merchandise, manufactures and commodities, defines adulteration and provides imprisonment and fines for offenders. It moreover declares that all penalties shall be kept as a separate fund for the expenses of the Commissioner in

enforcing the law. The very same day the Act of June 26, 1895 (P. L. 313), was passed repealing the provision of the Act of 1885 whereby an informer was allowed one-half the penalty and directs that all penalties be paid over for the exclusive use of the Commissioner in carrying on his work.

Sundry other acts have since been passed enlarging the field of inspection. They are so framed as to constitute parts of a general heading entitled "food laws" and place their enforcement under the Commissioner. Their subjects and dates are as follows: Milk, June 26, 1895 (P. L. 320); vinegar and apple products, July 5, 1895 (P. L. 605); vinegar, June 18, 1897 (P. L. 168), and May 21, 1901 (P. L. 275); cheese, June 23, 1897 (P. L. 202), and May 2, 1901 (P. L. 128); milk and cream, April 19, 1901 (P. L. 85); fruit juice, May 2, 1901 (P. L. 123); oleomargarine, May 5, 1899 (P. L. 241), and May 29, 1901 (P. L. 327); renovated butter, July 10, 1901 (P. L. 642).

The Act of 1895, however, is the law under which prosecutions for selling food products are now almost all conducted. It contains all the vices of the other acts and more, to say nothing of its unconstitutional feature of recognizing a State officer for the inspection of merchandise.

Before discussing the particular defects of this act and the abuses of its enforcement it is well to remember how important to our institutions are the doctrines of antipaternalism and the reasonable freedom of citizens. The Constitution of the State, moreover, solemnly declares: (Article I, Section 1) "All men are equally free and independent and have certain inherent and indefeasible rights, among which are those of enjoying and defending life and liberty, of acquiring, possessing and protecting property and reputation, and of pursuing their own happiness."

Certainly trade and commerce give rise to some of these rights, which refer not only to tangible property but include also reputations for honesty and fair dealing which many merchants deem their most valuable asset. It is true that these rights are not absolute. The banding of men into communities makes it necessary that each shall so use his own property and pursue his own happiness as not to injure that of his neighbor, a principle recognized by the time-worn maxim, "*Sic utere tuo ut alienum non laedas.*" For the practical application of this doctrine, indicated by the familiar expression "law of the land," it is accepted that we leave in the hands of our State legislative assemblies the power (except in so far as by our State Constitution we have

fixed a limit) to make such wholesome and reasonable laws as they shall judge to be for the good of the whole people. This is usually designated as the "police power" of a State, and by virtue of it may be enacted all such laws as may be necessary or proper to protect its citizens in their persons, their health and their property and to guard them against frauds, impositions and oppressions.

It is under the police power that all laws affecting articles of food must fall and their force is limited by the attainment of two purposes: (1) Preservation of the public health; (2) protection against frauds and deceptions.

Any law regulating the manufacture or sale of food stuffs which does not come within these two purposes is not a sound exercise of the police power of any State and must be declared to be a violation of the constitutional guarantee, that men shall have the right to defend their liberty, acquire property and pursue their own happiness.

This limitation cannot be better expressed than in the words of Judge Earl of New York (*In re* Jacob's Case, 98 N. Y. 98):

"Generally it is for the Legislature to determine what laws and regulations are needed to protect the public health and secure the public comfort and safety, . . . But they must have some relation to these ends. Under the mere guise of police regulations, personal rights and private property cannot be arbitrarily invaded, and the determination of the Legislature is not final and conclusive. If it passes an act ostensibly for the public health, and thereby destroys or takes away the property of a citizen and interferes with his personal liberty, then it is for the courts to scrutinize the act and see whether it really relates to and is convenient and appropriate to promote the public health."

It is quite possible that a law may be enacted which will technically be within these principles and have judicial approval as a sound exercise of the police power of the State yet at the same time be so construed that the methods of its enforcement become a crying evil. As was once said by an Iowa judge (Hannabalson *vs.* Session, 9C N. W. Rep. 93): "The law affords sufficient opportunity for spiteful and contentious persons to harass their neighbors by strict insistence upon technical rights." As this is true as to the law generally, what care should be exercised that special statutes do not aggravate existing, as to its penal sections, abuses! From this standpoint, therefore, and leaving for discussion in another forum the purely legal question whether the Act of 1895 comes strictly within the police powers

vested in the Legislature, let us consider whether it is a wise piece of legislation in its terms and its administration. "Good sense, good morality and good law are one and the same so long as they are not sundered violently by legislation or ignorantly by judicial error," was once aptly said by Chief Justice Bleckley of Georgia (Hull *vs.* Myers, 90 Ga. 674). Let us accept these words as a guide in considering the act.

It forbids all persons to manufacture, sell or offer for sale any article of food which is adulterated, defines the word "food" as including "all articles of food or drink by man, whether simple, mixed or compound," and says an article shall be deemed adulterated in seven cases: "(1) If any substance or substances have been mixed with it so as to lower or depreciate or injuriously affects its quality, strength or purity. (2) If any inferior or cheaper substance or substances have been substituted wholly or in part for it. (3) If any valuable or necessary constituent or ingredient has been wholly or in part extracted from it. (4) If it is an imitation of or is sold under the name of another article. (5) If it consists wholly or in part of a diseased, decomposed, putrid, infected, tainted or rotten animal or vegetable substance or article, whether manufactured or not,—or in case of milk if it is the produce of a diseased animal. (6) If it is colored, coated, polished, or powdered, whereby damage or inferiority is concealed, or if by any means it is made to appear better or of greater value than it really is. (7) If it contains any added substance or ingredient which is poisonous or injurious to health: *Provided*, that the provisions of this act shall not apply to mixtures or compounds, recognized as ordinary articles or ingredients of articles of food, if each and every package sold or offered for sale be distinctly labelled as mixtures or compounds and are not injurious to health."

Section 4 provides that the manufacturer or the seller must furnish samples for analysis if the value of the goods be tendered.

Section 5 reads: "Whoever refuses to comply, upon demand, with the requirements of section four, and whoever violates any of the provisions of this act shall be guilty of a misdemeanor and upon conviction shall be fined not exceeding one hundred nor less than fifty dollars, or imprisonment not exceeding ninety nor less than thirty days, or both, and any person found guilty of manufacturing, offering for sale, or selling any article of food under the provisions of this act shall be adjudged to pay, in addition to the penalties herein provided for, all necessary costs and expenses incurred in inspecting and analyzing such adulterated articles of which said person may have been found

guilty of manufacturing, selling or offering for sale: *Provided*, that all penalties and costs for the violation of the provisions of the act shall be paid into the State Treasury, to be kept as a fund separate and apart for the use of the Department of Agriculture for the enforcement of this act, and to be drawn out upon warrant signed by the Secretary of Agriculture and the Auditor General."

It will be observed that some of the definitions seem to aim at protection to health and others to prevent fraud being practiced upon purchasers, but in fact every one can be successfully used not only to interfere with lawful commerce but to subject citizens to punishment for acts which in no sense should be deemed crimes or even open to criticism. The absurdity of some of the definitions becomes quite apparent upon a few simple tests. Take the first one: if a manufacturer add to maple syrup any quantity whatsoever of refined cane sugar syrup in order to get the clearness and pleasant taste required for commercial purposes, no matter if he announce the fact by label and thus proclaim just what he is selling he is guilty of a crime because he has mixed in a substance which affects the purity of the maple syrup and that the act says is an adulteration. The same illustration will serve as to definition number two. A case of maple syrup was recently tried in a central county and the dealer was convicted under this section. As to number three, a manufacturer who extracts sufficient fat from the cacao bean to make a marketable cocoa can be convicted of selling an adulterated article because, in the language of the law, a valuable constituent had been extracted from it. No matter if the label on the goods tells the whole story, the result is the same, although the merchant is not deceiving the purchaser and is selling nothing unwholesome.

Under section four an illustration can be used which, while it may be extreme, will serve to show the needless interference with commerce for which this law can be used. Suppose a baker desires a *papier maché* imitation of a loaf of bread for display in his window. The manufacturer who sells him such an article can be convicted because bread is an article of food and it is a crime to sell any imitation thereof. Clearly the purchaser would not be deceived nor the public health affected, yet there is the law and the Food Commissioner does not have to show that the article itself is intended to be eaten.

According to section five a produce merchant can be held guilty of a violation of the act if a customer find the least decomposition at

the core of one potato or other vegetable in a bushel sold, and likewise a butcher cannot sell any spoiled meat to be given a dog or other animal, for in both instances the article would be in part or wholly of a decomposed or tainted animal or vegetable substance.

Under number six a bottle of catsup colored with cochineal or powdered red pepper pods cannot be sold, although such preparation has been a recognized commodity for years and is clearly labelled "artificially colored." The label will not save the merchant. He can be convicted because the color makes the article appear better than it really is as the definition puts it. The Food Commissioner has declared that no colored catsup can be sold, and some of the county courts have sustained him, although it is clear that the food is not injurious nor is the buyer deceived.

According to section seven, if the State Chemist find any ingredient that a jury will believe to be injurious if used even in only a great quantity, the manufacturer or seller can be convicted of selling something containing a substance which is injurious to health, for the Supreme Court has so declared in the case of Commonwealth *vs.* Kevin, 202 Pa. 23. The defendant was not allowed to show that the quantity used was harmless, and the Supreme Court declared that that was immaterial as the Act of 1895 is drawn. This is so, though it be known that the substance is a natural ingredient of the food itself. When it is considered that the simplest, commonest and most harmless substances can, by quantity, be made "poisonous or injurious to health," this decision, which of course had to be based upon the law as it is, reveals the absurdity of this section with glaring distinctness.

The Kevin case recalls the special fitness of the words of former Chief Justice Lowrie: "No wise and orderly mind can reasonably complain when he gets the common justice of the country, *though he may wish that the country were wiser in order that its justice might be better*" (Wister *vs.* Philadelphia, 3 Grant, 311).

The effect of the proviso, that the act shall not apply to mixtures recognized as ordinary articles of food, is most interesting. Having by the definitions declared all mixtures to be adulterations, the framer of the act decides that all mixtures as have up to that time been in use long enough to be recognized as ordinary articles of food shall not be considered adulterated and may be sold. This irresistibly suggests that the whole act should have a new title, such as, "An Act to prohibit new discoveries in dietetics." By these illustrations it must be apparent that much injustice can result from this law besides prompt-

ing the serious criticism that in many of its sections it has the effect merely of prohibiting the sale of wholesome articles of food, thereby dangerously approaching the limit of legislative exercise of the police power.

It might be that a manufacturer or merchant could escape some of the meshes of this statutory net by well labelling his goods. If they were then proven to be wholesome the statute would be inapplicable, there being no menace to the public health or commercial deception. Unfortunately the act is so drawn that each case must be governed by its own particular facts, thus requiring the expense and notoriety of a public trial in which the victor is not always the gainer.

On the whole, while the statute may be valid and even just as to some cases, in many it invades and impairs individual property rights, prevents the use of many desirable food preparations and needlessly interferes with trade.

The common sense which should be applied to its interpretation is indicated by our present Chief Justice when he said, in reversing a conviction in a milk case: "The act in question deals with the affairs of everyday life and is highly penal in its provisions. There is, therefore, double reason why its language should be construed according to its popular practical everyday use among the people. . . . This is an age of mechanical and industrial revolution, and all of us who have passed middle life have seen an entire change in the methods and processes of production in nearly everything that we use in our daily life" (Commonwealth *vs.* Hufnal, 185 Pa. 376). More than this, all men upon a moment's reflection will perceive that an article of food is not in fact adulterated simply because something is added to it. Scarcely a meal is partaken of by any person that does not include plates in which several ingredients are mixed. The fact is that two terms have been confused or their meaning purposely misstated as to that branch of the food question relating to spoilation. Mr. George Merck, one of the most experienced industrial chemists, in an open letter upon this subject recently addressed to United States Senator Dryden of New Jersey, said: "Food *adulteration* is a crime and must be stamped out. Food *preservation* is a necessity, and must be permitted. Eliminate the legitimate and honest employment of food preservatives to-day and you will be confronted by a food problem that will represent so serious an aspect that mere food *adulteration*, reprehensible as it is, will sink into utter insignificance. . . . The

danger of ptomaine poisoning following the consumption of decayed foods is real; the harm supposed to result from the use of preservatives is purely imaginary."

It is true as a legal proposition that a statute may be constitutional or otherwise according to the facts of a particular case yet wise legislators will refrain from enacting laws of uncertain validity and judges who have not served so long or lived so exclusively apart from their fellow-citizens as to have gotten out of touch with the common experiences of their era will use extraordinary caution in upholding them.

While attention has been thus called to some of the incongruities, imperfections and absurdities of the language of the law itself, they pale in importance before the system now well established for its enforcement.

It will be remembered that all fines and costs are directed "to be kept as a fund separate and apart" for "the enforcement" of the act. Similar clauses are found in almost all of the food statutes. Those funds are "drawn out upon warrant signed by the Secretary of Agriculture and the Auditor General." The Food Commissioner is authorized to employ special agents, detectives, clerks, chemists and attorneys, although in all counties the State or county already pays for constables, policemen and district attorneys, and in many also for competent chemists as assistants to Boards of Health. All of these officials could well attend to the cases of infractions of food laws in their several districts without extra expense to the State. This was one of the arguments used in favor of the constitutional provision that is now being daily violated. However, the Food Commissioner does employ these special aids and there is no legal check upon their number or their compensation. The Bureau was not conducted upon a very extensive scale immediately following the passage of the act but as the methods of increasing the revenue under cover of its terms became better understood by those in high officialdom the personnel was increased until, as now conducted, the Dairy and Food Department of this State presents a feature of the administrative branch of goverment *unsurpassed* for its availability in State and local politics, its power to defy private rights and its opportunity to perpetrate fraud and to unjustly harass the people. All of these possibilities flow from the revenues derived under the various food laws and the power to disburse the same without adequate legal supervision.

The Dairy and Food Division of the Department of Agriculture

collected in the year 1901 the sum of $34,705.19; in the year 1902 $43,635.41, and in the year 1903, $93,458.71. What the amount will be during 1904 cannot now be stated, but the present Commissioner, while attending a meeting of the Butter Men's Association a few days ago, declared that $75,000.00 had been collected in fines this year in Pittsburg alone. At each session of the Legislature a lump sum is appropriated out of these collections for the succeeding two years, to pay the salary of the Commissioner and the expenses of his office, based upon estimates furnished by himself. Provided he does not exceed the appropriation, and acts in the name of his official chief, the Secretary of Agriculture, he may employ as many agents, detectives, chemists and lawyers as he sees fit and pay them at the most liberal, rates. His chief is largely guided by him in such matters, as the Dairy and Food Division constitutes the most important part of the Department of Agriculture. Indeed, so important is it that of late newspaper articles said to have been inspired by the Commissioner have declared that he will be elevated to the dignity of a cabinet officer of the Governor. It is sincerely hoped that some one will remember the Constitution in time to prevent such an occurrence.

What can *not* be done with these revenues and this power of appointment by a Commissioner devoted to the State "Organization?" The receipts for 1902 were more than doubled in 1903 although the present Commissioner did not assume office until April first of the latter year. His published annual report for 1903 gives details of receipts but omits all the items of disbursements. What the latter were he does not therein inform the public. How many agents, detectives, clerks, chemists and lawyers could be employed with the $93,000.00 collected in 1903? How much strength could be added to the "Organization" by a judicious distribution of that power of employment among the several counties? These conjectures do not end with the questions. The facts are that each year the number *is* increasing and that the appointees are men commonly reported to be of local political influence or who have the backing of politicians recognized as leaders. Take Philadelphia as an illustration. The district attorney and his assistants are considered competent in learning and numbers to care for the Commonwealth's interests in this county yet the Food Commissioner has here two attorneys in his employ reputed to receive $2,000.00 per annum each. One is a State Senator-elect and also a political leader; the other is a life-long friend of the Governor and is said to have been appointed upon that ground. The City Board of Health has several inspectors, and there are not a

few constables and no insignificant police department for enforcing all laws, yet the Food Commissioner has a corps of men whom he refuses to call inspectors or detectives, but dubs "agents," for visiting stores, inspecting merchandise and swearing out warrants. The whole State is just as carefully being looked after, although up to this time it has not been found necessary to employ a chemist in each county, some six being sufficient to analyze all samples brought in by the inspectors. They are, however, kept very busy, and are paid irregular sums for their work, not being carried as employees. This does not prevent them being employed as chemists of food manufacturers and giving private certificates of analyses.

The small but growing army of attachés are governed by a hierarchy at Harrisburg schooled in noncommittal declarations, secret instructions and collection of revenue. There is the Commissioner, his assistant, and his attorney in chief. From the headquarters of these three issue the orders to inspectors, chemists and local attorneys and also the information contained in a "Bulletin," published monthly, giving the names of manufacturers stated on samples which have been examined and the names of persons arrested. An examination of only a few of these "Bulletins" reveals the names of some well-known manufacturers whose goods have been condemned by the chemist as "adulterated," but as to which cases have been abandoned for "insufficient evidence." There are also names of merchants thus published as having been arrested for selling adulterated food but who were discharged by magistrates for want of evidence. In a recent case one of the oldest manufacturing firms in the State was published as having made an adulterated article and the retailer was arrested. The manufacturer took up his defence and so clearly demonstrated the error of the two Food Division chemists that they admitted it and the court ordered a verdict of acquittal. How far such a publication is libellous it is not necessary here to determine but the facts provide ample grounds for serious thought in that regard. Indeed a few weeks ago a suit was commenced in this county against the Commissioner upon that theory.

It is reported to be a rule that the Commissioner will sign no letters as to the decisions of his department or the interpretation of the laws. Personal interviews, if obtained at all, are equally unfruitful. Communications are answered by the assistant, generally, although occasionally the chief attorney replies as profoundly and as evasively as the oracle of Delphi.

Letters of well-known manufacturers within and without the State, requesting instructions for labelling their goods to conform to our laws, have brought no satisfactory response and in some cases none at all.

In order to ascertain the vices of this legally sanctioned system a glance at the methods of inspection, analysis, arrest and trial will be profitable.

Those employees of the Commissioner who obtain the samples upon which prosecutions are based, and who always insist upon being called "agents" instead of "inspectors," are the most important instruments of the Bureau. Is it by accident that they take most of their samples from the small stores of remote country villages? Is it mere chance which leads them to select certain commodities from small merchants in western counties when the factory of the maker is in Philadelphia? Is it entirely an oversight that the goods of a large Allegheny county manufacturer are attacked in the hands of a retailer in a northeastern county?

While the questions may not be answered, the facts warrant them nevertheless. The Commissioner has his agents covering practically the entire State, and they are all controlled from Harrisburg. It would be easy to visit the many large manufactories of food products, but it is a fact that of the fines collected from general food cases in 1903 ninety-eight per cent. came from the arrest of men who did not prepare the goods. In some rare instances the factories were in the same counties, but here in Philadelphia three such cases among the few, were never heard of after the preliminary hearing, and nothing was ever paid the Food Department. The samples in those cases, moreover, were not taken from the factories but from small retailers. Last year about ninety-five per cent. of the cases were against retailers for selling goods manufactured out of the State. Diligent search has moreover failed to reveal a single case of any prominent Pennsylvania manufacturer being tried for selling adulterated goods, although in several instances goods of such firms, when in the hands of retailers in distant parts of the State, have been made ground for arrest. Of all the cases brought since 1895 not fifteen per cent. have been contested to a finish in a court of record. The arrested man learns quickly that if he will pay the minimum fine of $50.00 the matter will end. He generally does so because when he considers the cost of attorneys and expert witnesses he realizes that even victory will be a defeat, practically considered. Indeed, he pays sometimes upon mere threat of arrest, as happened in five cases here in March of this year.

If a man does indicate an intention to defend himself by giving bail to appear in a court where he will be tried before a judge and jury, it would seem that the department loses interest in the prosecution. At least that conclusion is supported by the number of cases which are never brought to trial, are *nolle prossed*, or are abandoned for want of evidence, etc., presumably by the Commissioner's consent. It may be that the settlement of cases before magistrates takes too much time to permit him to give attention to a court trial.

Many merchants in different parts of the State, by sworn statements, have complained that these inspectors or agents invade the private portions of stores, annoy by handling goods, overawe clerks by their arrogance and sometimes insist upon taking samples of goods which are not for sale. Among several instances of the latter may be cited one in which the inspector took a bottle of cider which a clerk told him was not for sale as it was only intended to be sold while sweet, the bottle being among some the proprietor, who was absent, had withdrawn from sale on that account. Against the protest the inspector threw down some money, said he would take it anyway, and a short time thereafter caused the storekeeper's arrest. The manufacturer being in another State, and finding that the cost of trial would treble the fine, arranged with the merchant to pay without contest.

After the inspector has secured the sample,—no portion of which is ever left with a merchant for a test by his own chemist,—he sends it to one of the chemists employed by the Food Department to have an analysis made. It is then not difficult to frame one of the varied possible charges of adulteration under the elastic definitions of the Act of 1895.

These chemists form a sort of close corporation, and really ought to have the power to issues decrees fixing all standards and tests for food and drink. Not that the standards or tests would always have the support of the eminent chemists of the country, but one would at least have something upon which to bind the State Chemists to a certainty. They can honestly be charged with fixing arbitrary standards, for they have done so in vinegar and other commodities. The tests of some of them are incomplete, careless and perfunctory. In a chocolate case last year one testified that he found wheat starch granules in the goods, although he admitted that he made only a microscopic test. The evidence was clear that no wheat starch had been added from boiler to counter. This same chemist and another subsequently declared likewise in a similar case, but both admitted

their error on seeing an eminent professor of the University of Pennsylvania demonstrate that a certain degree of heat applied to the cacao starch granule so modified its size and general appearance as to make it identical with the wheat starch granule. Some of them are also deficient in general chemistry. One recently admitted upon the witness stand that he did not know that any fruits had traces of benzoic acid as a natural ingredient.

It is upon the work of these inspectors and chemists that the Department requires its different special attorneys to go into the several counties of the State and prosecute such defendants as will not be induced to pay the minimum fine before the magistrates. In some counties there are two attorneys, in others one, and in some sections one attorney will have charge of cases in several counties. If a manufacturer in Philadelphia wants to protect his retailer in some far county by defending a case, he finds difficulty in getting any information about the date set for trial, and is liable to attend a distant court with his counsel and expert witnesses, at large expense, only to be told, after several days, that the special attorney for the Food Department has decided to postpone the case till next term. Upon protest to the district attorney of the county that gentleman will say that he has no control over the food cases. Is it any wonder that the manufacturer often decides to pay the $50.00 and go home? Is it surprising that soon after some more of his goods are attacked in a still more distant county? Is it furthermore at all strange that the thousands of jars of the same goods right in his factory in Philadelphia are never looked over or sampled by a Food Department agent? Is there any reason why one never hears of a prosecution as to certain articles commonly known to be adulterated, such as butter? It is common knowledge that annatto and the borons are in general use for coloring or preserving that article. This forgetfulness on the part of the Commissioner has become so conspicuous that an organization in Scranton recently had the boldness to complain of the apparent oversight. Whether the farmers who sell colored butter will continue to be exempt from prosecution will depend upon whether the Commissioner keeps his promise to have the coming Legislature pass a law permitting the use of annatto in our commonest article of food which he recently declared should be done. It is probable that he will indeed have that persuasive power.

In the few cases that do get on for trial the defendant has to contend not only with a refusal to permit him to have the goods analyzed,

but also a jury frequently unlearned and easily swayed by the popular impression largely created by this very unreasonable crusade, that almost all food is adulterated and that manufacturers prefer to make unwholesome goods. Moreover, the special attorney whose salary is paid out of the revenues of the Food Department will manage to inform the jury that it is not the defendant who is really on trial, that if they convict him he will not be imprisoned but only fined, and that the money will be paid by the manufacturer. In a recent case up the State the special attorney had the effrontery to express these thoughts, in almost these words, directly to the jury, in his final speech, knowing that defendant's counsel would have no opportunity to reply. Truth was not in his words for the manufacturer was not present nor represented and was not defending the case.

There are also other influences which the Food Department depends upon, it seems, for a case was brought against a retailer in a distant county for selling goods manufactured near Philadelphia, and when the department learned that a vigorous defence would be made a *nolle pros.* was entered, and the matter dropped after the manufacturer had incurred hundreds of dollars of expense. One of the inspectors said that the department would wait till it could get a case in a certain other county where he lived and "took a hand in politics," and where they had never lost a food case. They did, and they convicted the merchant in the face of the clearest evidence, showing not not only that the goods were quite wholesome and that no purchaser was deceived, but that they had been a recognized and accepted staple commodity throughout the United States for many years.

These are some of the criticisms to which the Food Commissioner, his inspectors, chemists and attorneys have opened themselves in enforcing the Act of 1895, which in itself obviously invites or makes possible this invasion of private rights by recognizing an office prohibited by the Constitution.

The remedy for all this lies in abolishing the office of Dairy and Food Commissioner, the passage of an act enabling each county or municipality to appoint food inspectors as provided by the Constitution, the repeal of the Act of 1895 and the enactment of a rational food law based upon preservation of the public health and protection against frauds. The keynote of such legislation was sounded by the distinguished Chief Chemist of the Agricultural Department at Washington, Dr. H. W. Wiley, in a recent speech before the students of the College of the City of New York. Said he: "Food adulteration is not

necessarily dangerous or vicious; it is the food adulteration which involves deception that is bad. I am not a man to go about telling people what they may and may not eat. . . . That is to say, so long as no fraud is practiced and the consumer is told the character of the food stuff employed, I hold that there is no adulteration within the meaning of the law."

The new statute should simply be an elaboration of our Act of March 31, 1860, along the lines of the English Merchandise Marks law which requires that every article shall be of the character asked for. It should also contain the following features:

(1) That no article be considered food or drink unless sold to be used as such by man. (2) That no unwholesome food or drink be manufactured or sold. (3) That all commodities be truthfully labelled whether pure or mixed. (4) That all mixed articles be labelled with list of ingredients. (5) That all goods artificially colored or preserved be labelled so specifically. (6) That violation of any of these provisions be punished with fine and imprisonment after notice that any particular article has been found to be unlawful. (7) That in cases in which the goods have been manufactured out of the State and have been received for sale in due course of business only a fine shall be imposed for the first offence. (8) That all fines and costs, including reasonable expenses for analyses and tests, be paid into the treasury of the particular county or municipality. (9) That all samples be stamped for identification in presence of the seller, and a portion thereof be left in his possession or tendered to him at the same time.

These are but leading ideas. Other details will present themselves to whoever may draft a formal act.

In conclusion, it seems clear that the office of Dairy and Food Commissioner is unconstitutional, and that our existing food statutes are, if not unconstitutional, at least quite imperfect and open to many just complaints.

Our representatives meet in General Assembly next month and every effort should be made to secure reasonable and adequate legislation upon this important subject.

The Evaluation of Evidence as to the Pharmacologic Action of Food Preservatives.

BY THOMAS LUTHER COLEY, A. B., M. D.

It is quite impossible to distinguish between drugs and poisons. Almost all remedies given in excess cause dangerous or fatal symptoms, while many poisons are valuable remedies in small doses. Some bodies may in fact be remedies, foods, or poisons according to the quantity ingested and the method of application.—CUSHNY.

In order to state clearly my position on this mooted problem, I shall briefly go over a few facts which have impressed me as necessary to a fair comprehension of the subject.

As an economic principle it is apparent that we cannot feed a nation of eighty millions of people from the farm to the table or the local abattoir to the table. The greatly congested population of certain sections of our country causes the demand for food stuffs to far outweigh the amount produced locally. Thus arises the complex problem of the transportation of food, which must reach the consumer in an appetizing and edible condition. If no chemical food preservatives are added a portion of the output of all our establishments must spoil, and thus a dearth of food result causing a rise in price of all foods to the consumer. Such a state of affairs would no doubt prove a great hardship to the wage earner.

The use of chemical preservatives becomes a necessity and the manufacturer is confronted with the difficulty of selecting such means as will be effective for this purpose and harmless to the consumer. The time at my disposal prevents a discussion of the limits of refrigeration and the greater perfection of methods of canning, etc.

The chief objection urged against the use of any food preservative is that it adds an ingredient to the food foreign to it and which, if used in large amounts, might prove deleterious to the consumer.

Again, the use of preservatives renders fraudulent operations possible, the consumer buying a "preserved" for a fresh article. Against this it may be said that the dangers usually arising from partaking of a reputably prepared food to which preservatives have been added, is as nothing in comparison to the dangers arising from the consumption of food products which have undergone putrefactive changes.

Further, by the use of such preservatives many articles of diet are placed within the reach of those, who otherwise could not procure such variety of excellent foods.

In our own country with its State laws widely at variance the regulations for the preservation of food are at present creating numberless lawsuits and prosecutions, often inflicting undeserved damage upon the reputation of business firms, but in other instances the enforcement of these regulations is proving of great value in detecting and preventing the sale of distinctly impure articles. There is a vast amount of sentimental and thoroughly unscientific talk about the so-called preserved and embalmed foods. The ignorant layman is apt to hold up his hands in horror at the thought of an acid having been added to anything he eats. For, to him, the word acid implies something that will gnaw away or destroy any tissue with which it comes in contact. He does not recognize that he himself adds acid to his food as a condiment in the form of vinegar or that the stomach requires the presence of hydrochloric acid to perform its function of digestion.

The great importance of the questions involved in a consideration of food preservatives is well recognized. It is for medical men to discuss broadly and scientifically means utilized commercially and to form ultimately a just opinion, wherein shall be included the shortcomings of methods in vogue and further, helpful suggestions, which may be followed by those who prepare our food stuffs.

It is but right at the beginning of our study of the subject to do away with prejudice and to deal squarely with facts as they present themselves.

In the first place, we must disabuse our minds of the criminality of intent on the part of reputable manufacturers, and draw a sharp line of distinction between adulteration and food preservation.

There is no defence to be offered for fraudulent goods; preserves, for example, that may have been bought for strawberry which are made of apple jelly, glucose and anilin, with perhaps not even the natural flavor of the strawberry added. Were this the whole question involved in our efforts for better food and purer food there would be no other side. No reputable man could for an instant defend fraud, or palpable intent to deceive. When, however, a preserve or strawberry jam is purchased, which is the proper natural product well prepared, and to that jam the manufacturer adds a minute quantity of some preservative, benzoic acid, let us say, then it cannot be claimed that the purchaser is cheated by having purchased an article of inferior food value to the oft-referred to "strawberry preserve" that our mothers made!

We are obliged to look upon certain economic principles in our

grasp of this subject. We must heed the demand for foods of good quality at a low or moderate price. This thought as to food preservation must apply in a broad sense to all our articles of diet which are liable to putrefactive changes.

If, prior to a decade ago, the use of very large quantities of table salt, vinegar (acetic acid) or wood smoke had not been generally known and by custom of ages sanctioned, then there would, no doubt, have been measures directed against the purveyers of goods so treated, not because they were bad, or harmless in a broad sense (for they are not all harmless) but because they were new. The conservative consumer, through his courts of law, strikes hard at innovations in food preparation; but it is unscientific and narrow to condemn a process as bad simply because it bears the stamp of novelty; there must be weightier reasons to urge against such means.

The chief causes of preconceived objections to be urged against food preservatives in general are matters of opinion and personal bias rather than evidence. It is said that many of these preservatives have their uses in medicine. They are, therefore, "drugs" or "noxious chemicals" and the attorneys in the various food prosecutions make great profit out of their appeals to juries: "Do you want your food drugged?"

The modern practice of jury pleading does not resemble that of half a century ago in its bombastic, rhetorical flights, but few can resist the thrust that some of these preservatives might, in large quantities, prove poisonous. "Think of it, gentlemen of the jury," they say, "they are putting poison in your food, in the food you give your wives and children," etc. Upon this point even some of the members of our own profession need enlightenment.

All of our foods, all substances about us, have their potential recognition in chemical terms, according to König, for example, 100 parts of the ash of the white and yolk of a fresh egg are found to have the following composition:

	Yolk.	*White.*
Potassium	9.29	31.41
Sodium	5.87	31.57
Lime	13.04	2.78
Magnesium	2.13	2.79
Iron oxide	1.65	0.57
Phosphoric acid	65.46	4.41
Sulphuric acid	....	2.12
Fluorine	0.86	1.06
Chlorine	1.95	28.82

Other observers add silicic acid in proportions of 0.28 to 0.49 per cent. This is an unfamiliar and formidable analysis to bring before the unsuspecting. What is habitually eaten as simply a fresh egg, and eaten with personal satisfaction and with no harmful results, contains among other things what are popularly referred to as "noxious" chemicals; chlorine, fluorine, phosphoric acid, sulphuric acid, etc.

An egg, like every food substance, has its portions which possess food value and its portions which do not. We are by no means certain of the action of many of the component parts of food stuffs. The mere fact that nature puts a trace of benzoic acid in cranberries may be a reason for its use in other foods for preservative purposes, but that reason has never seemed forceful to me. Because salicylic acid is also found in certain fruits would be no reason for the use of this substance in other food stuffs. Because a substance is present in chemical combination in food does not necessarily give that substance food value, nor, on the other hand, does it necessarily imply a rateable proportion of deleterious effect. There is no reason to believe that other substances may not be added without harm, in small quantity, by the hands of man to food stuffs to which they are foreign. Certain it is that in all foods only parts of the entire product are possible of assimilation for food purposes, the other portions may be passed off as waste or may be absorbed, but in the small quantities found are quite inert. If these particular substances were found in larger proportions they might be productive of harm. The basal fact must be borne in mind that they are not present in physiologically active quantities in most instances, as far as we now know, and the question arises, if we limit absolutely the quantity and character of our food preservatives and safeguard the public by informing them of the added substance, is harm likely to be inflicted on the consumer?

The action of chemical substances on the animal organism depends upon a number of factors, some of which are well understood and others of which are not so well understood.

We are aware, in a very great number of instances, of the difference between the action of a lethal dose and the action of certain non-lethal fractions of this dose. It is not true always, or even generally, that the action in such case is relatively different, depending only on the amount, and, consequently, resulting only in intensity of effect. The action in a large number of cases of a small dose is directly opposite to that of a large dose. Witness, for example, the action of small doses of arsenic, mercury, copper, alcohol and ether.

The effects of repeated administration of small doses by no means parallels the action of one large dose of a chemical substance.

The element of toleration, of susceptibility, is a factor of greatest importance in comparing the action of a drug on animals to its action on man. It is not possible to generalize from a few experiments on animals the full pharmacologic action (toxic or otherwise) upon a human being. A great drawback to the results of such studies, especially in the field of chemical food preservatives, is that the series of experiments undertaken on animals have not paralleled, or even approached, the identity of circumstances surrounding such administration in human beings. These points will be discussed somewhat in detail later. Suffice it to say here that results drawn from such studies as that in which a man would receive by comparison with the animal experimented upon some three-fourths of a pound of preservative in one day can scarce compare in effect, in such gigantic dose, to the conditions actually pertaining. It is also equally absurd to deduce the action of a substance taken by man mixed with his food to the effect of the same substance thrown into the the circulation of an animal directly. It is equally fallacious for fair comparison, to administer a substance in capsule, thus concentrating its action and compare the results obtained to those in which it is given in dilute solution or mixture.

In the evaluation of the harmful effect of drugs upon a man or an animal it must be made certain that the conditions manifested clinically, or those found postmortem, are to be ascribed to no other cause.

The greatest fault to be found in the researches of experimental pharmacologists is, as has been frequently pointed out, but not sufficiently taken to heart, in drawing general conclusions from limited data. We know, for example, that ipecac or tartar emetic will not cause vomiting in rabbits owing to the fact that the position of the stomach of the rabbit is different from that of man and that such an animal cannot vomit. The experimenter who reasoned that he had found by careful research work on rabbits that tartar emetic and ipecac were of no use as emetics in man would illustrate a phase of the observation on this point.

"The amount of a drug which actually comes in contact with and affects the tissues depends upon several conditions: (1) the quantity actually given, (2) its proportion to the body weight, (3) the rapidity of its absorption by the blood from the place of introduction, (4) the condition of the circulation in various parts of the body, which deter-

mine the quantity of the drug carried to each, (5) the rate of its absorption by the tissues, (6) the rapidity of its excretion." (Brunton.)

There is an important factor which governs the scrupulous and the unscrupulous alike in the use of food preservatives even in the absence of any or all restrictive legislation. In the very nature of the preservative substance (with few exceptions) only the smallest fractions can be added without the consumer being made aware instantly upon tasting such food stuffs that the goods are not of the natural quality. The flavor is gone or there is present the characteristic taste of the preservative. It is only in the action of minute doses, then, that this phase of the problem interests us. Such doses as a consumer might take even over a protracted period without being aware of the cause of any resulting discomfort. Had laws been enacted a decade ago which limited the use of preservatives and required notification of their presence, by this time we would probably have been able by clinical proof to have demonstrated whether the hypothetic possibilities of harm are true or that such was not the case. Indeed, as the problem stands there is a dearth of trustworthy data upon this point. Some claim that the absence of proof of the harm of such substances taken by the consumer in ignorance, have done, is to be explained by the natural difficulty of tracing the etiologic factors in the production of much gastric and renal disease.

In expressing a view on these points we are again in the realm of opinion rather than evidence.

Large doses of any powerful drug upon an animal, or series of animals produces certain profound changes which the pharmacologist is able to record and interpret and compare with the action of the identical drug upon man. Competent allowance must, of course, be made for the various factors of proportion of dose to body weight, the determined susceptibility of the animal, allowance for comparative anatomic variations, as in development of the nervous system, etc.

In general it may be said that, the action of minute dosage over long periods of time has not been studied.

In the study of food preservatives it is just this question which remains to be settled.

In the conclusions of the Report of the Departmental Committee appointed to inquire into the use of Preservatives and Coloring Matters, in the Preservation and Coloring of Food (London, 1901) it is stated that: "The medical evidence, generally speaking, comprises for the

most part opinion arrived at after a general consideration of the issues involved, but such opinion was not always based directly upon fact. The physiologic evidence consists of the citation of the results of more or less exact physiologic experiments. But, unfortunately, in the majority of cases the conditions under which the experiments have been made have only partially imitated those conditions which obtain in the actual taking of preservatives by the human subject of all ages for indefinite periods of time."

In order to illustrate some of the features of the general subject, which would seem to indicate that the facts supposed to argue against the use of certain substances are in reality false deductions. I shall briefly review the general action of sodium sulphite.

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The same line of criticism here adopted applies to much of the literature on other chemical preservatives.

We know that the sulphites are incompatible medicinally with oxidizing substances, which convert them into sulphates, and with mineral acids.

The amount recommended for use as a meat preservative is, at most, one pound to a thousand pounds of meat—one per mil. When sodium sulphite is so added to meat in a perfectly fresh condition it will arrest putrefactive changes at room temperature for twenty-four to forty-eight hours. During this time, by oxidation, the sulphite is gradually converted to sulphate, and the red color of the fresh meat, temporarily maintained by the oxyhemoglobin, gradually lessens. When raw meat thus treated reaches the consumer the preservative has been added a varying number of hours, and depending upon the rate of oxidation the sulphite has in part disappeared, having been converted into the sulphate. In another paper dealing with certain phases of this problem I shall detail a series of experiments having for their purpose, in part, the determination of this loss of sulphite on exposure and, further, the loss of the remaining sulphite by the various methods of cooking. I may say, however, that after the exposure of meat for twenty-four hours, but 61 per cent. of sulphite could be recovered, showing an oxidation of 39 per cent. Meat, with sulphite added as a preservative, having then been exposed twenty-four hours was then fried, and but 5 per cent. of the sulphite could be recovered, in boiling such meat, sewed in a sausage casing, but 1.5 per cent. of sulphite could be recovered. These points illustrate the fact that of the small percentage of sulphite added, but a fraction finds its way into the human stomach after the usual methods of preparation.

This points out the necessity of the knowledge of the action of minute doses. Grant that a man partakes of a large meal of meat and vegetables preserved with sodium sulphite, the oxidation of the sulphite will naturally continue in the mixed stomach contents for a period and the amount of hydrochloric acid finally neutralized by the sulphite thus introduced must be infinitesimal.

It is asserted that the danger of the employment of sulphites exists in their arresting digestion, neutralizing the gastric juice, entering the blood and robbing it of its oxygen, causing inflammation of the stomach, kidneys, lungs, etc.

It is pointed out that sulphurous acid gas even in strength of 5-1000 is a violent irritant to the respiratory mucous membranes and no allowance is made for the fact that the small amounts of sulphurous acid evolved in the stomach must be infinitesimally diluted, and that the gastric mucous membrane is not the sensitive respiratory mucous membrane.

It was formerly the practice to give large quantities of sodium sulphite medicinally for the very purpose for which sodium bicarbonate is used, and it is asserted on good authority that the primary neutralization of hydrochloric acid aids digestion rather than impairs it by the subsequent increased outpour.

Enormous doses of sulphite are necessary before the urine excretes sulphite unchanged. The drug is eliminated by the kidneys with great rapidity and completeness, 96.5 per cent. by the fourth hour. This necessarily implies no irritating effect for the total output is small, and the labor of the kidneys is not appreciably increased. It has been stated in the testimony of a witness, in a recent trial, that the sulphites act by "robbing the blood of its oxygen." Considering the unlimited supply of oxygen at our demand with every respiration, and the very small amount of sulphite ingested, such a "robbery" of the blood must be petty larceny of a very innocent sort.

The further statement has been made by the same gentleman that sulphites administered in quantity cause destruction of the red blood corpuscles. I have failed to find the slightest evidence in the work of any investigator to sustain this contention, and, indeed, Pfeiffer contradicts it flatly. Sulphite would have to be given in enormous doses to be absorbed into the blood as a sulphite and remain unchanged in the presence of an oxidizing medium.

In the literature of the use of the drug for pyemic conditions and malarial hematuria are recorded enormous doses employed,

as much as forty to sixty grains every two to three hours. No ill effects have been observed from such use. Can it be possible that the sulphurous acid formed from such doses is the deadly irritant to the gastric mucosa it is claimed to be? Is it not true that if such were the case we should find in the records of its former generous employment important observations on this feature? The extremely corrosive action of H_2SO_3 would certainly have given evidence by causing fatal symptoms were it evolved in the human stomach in the great quantity that it has been theoretically claimed to be.

It would appear that theoretic reasoning based on testtube experiments is responsible for these unsupported claims. The action of hydrochloric acid in considerable quantity on dry sodium sulphite in a testtube, is a different proposition from the action of such sulphite, in small quantity, mixed with food in the human stomach. In the stomach we have oxidizing agents at work rapidly reducing the sulphite to sulphate and when such sulphites are present in but small quantity, a very minute, if any, conversion of SO_2 can possibly occur by reaction with the hydrochloric acid.

In the several papers of Pfeiffer, Kionka and Harrington bearing on the action of the sulphites, we are able to criticize the methods employed and results deduced in a general way which will illustrate how fallacious are such findings to settle the question under dispute, *i. e.*, the action of a drug (sodium sulphite in this instance) as a food preservative. Pfeiffer, for example, took a half gram on an empty stomach, fasting, and administered the same to a number of his friends. The symptoms which followed were pressure and pain in the stomach, retching and general discomfort. Also, he states the taste of the salt was extremely offensive. There is no comparison in such an experiment to the use of sulphite in minute quantity mixed with food. The same criticism holds of his studies of lethal doses of the drug administered by subcutaneous injection, or introduced directly into the circulation. These studies are interesting but their deductions do not apply to the question with which we have to deal. In this connection an interesting fact develops bearing on the toxicity of the sulphites. Pfeiffer found that in warm blooded animals the lethal dose by subcutaneous injection was from nine to twenty-five grains (0.58 to 1.62 grams) for every two pounds of body weight. An average fatal dose, subcutaneously injected, for a man weighing one hundred and fifty pounds would be 1,275 grains, if the comparison actually applied. If given internally, larger doses than those above mentioned are required

to give the same symptoms. The blood is not affected. Dogs cannot be poisoned by the internal administration of sodium sulphite, unless the esophagus be tied after the introduction of the drug into the stomach. Pfeiffer concludes from his experiments that "the sulphite exerts a distinctly poisonous action on both cold and warm blooded animals, but they are so rapidly changed into sulphates that, unless very large doses be given, a sufficient amount of unchanged salts is not present to produce a poisonous effect." Pfeiffer used a salt containing 25.25 per cent. SO_2. Kionka in his experiments used a salt of twice the strength in SO_2 as Pfeiffer. He was able to kill a rabbit in four hours by introducing into the stomach a quantity equal to 359.2 grams of sulphite of 25.25 per cent. strength in SO_2 for a man weighing sixty kilos.

Kionka in two experiments with sulphite as a meat preservative in the strength of ½ per 1,000 fed dogs with a given quantity of meat so treated for sixty-six to sixty-eight days respectively. During the experiment the animals gained weight and appeared well. They were killed and the postmortem studies showed a perfectly normal stomach and digestive tract, but there were some areas of hemorrhage in the lungs and areas of inflammation and degeneration in the liver and kidneys. In these experiments the proportion of preservative was not excessive but the quantity of meat eaten by the dogs may be gleaned from the fact that a dog weighing 12.75 kilos received in sixty-eight days 56.3 kilos of meat containing in total, 186.75 grams of sulphite. This would represent a daily feeding of nearly ten kilos of such meat for a person weighing sixty kilos. Can a comparison be drawn from such experiments, and is it not marvelous that the alimentary tract was practically normal after such abuse of food?

Harrington's experiments dealt with six scavenger cats, with no knowledge on his part of the ravages of disease in their past venturous lives. They were fed for five months with raw chopped meat containing 0.2 per cent. of pure sodium sulphite. No record is made of the amount of meat consumed during the period, or consequently the total amount of sulphite consumed. The cats were doubtless at first eager to eat anything and may have gorged themselves. They gained weight for a number of weeks and, this in spite of their being necessarily confined and not leading their usual lives. At this time the diet may have palled upon them and they probably consumed less.

At no time, according to Harrington, did the animals show any outward evidence of poisoning up to five months when all were killed

with chloroform. Parenchymatous degeneration of the kidneys was found but no such extensive lesions as in Kionka's animals. The amount of sulphite was 0.2 per cent. against 0.1 per cent. used ordinarily in meat to secure the best preservative effects.

Not only was this a great overdose extending over five months but the animals were living confined lives and were poor specimens to begin with. Further, they were killed with chloroform and renal lesions were to be looked for.

Are the deductions made from such experiments trustworthy, as far as they relate to the problem of food preservation? They have value in proving the lack of irritating action of the drug on the alimentary tract and would seem to settle the point conclusively.

As to the question of the action of the sulphite on gastric digestion, I have made a number of studies in vitro which will be published in the paper to which I have previously referred.

Basing my methods in part after that of Chittenden and following in vitro Nature's methods as far as possible, by pro onged digestion I have found that proportions up to 1 per cent. of sodium sulphite have no retarding effect as determined by the amount of syntonin, albumose and peptone in the flasks at the end of a given time.

One more point as to the sulphites; it may be possible to condemn their use because they maintain in chopped meat the natural color of the meat for a varying time in ordinary temperatures (twenty-four to forty-eight hours) but the evidence of their harmfulness on the economy is certainly wanting. We garnish a dish to make it appear more attractive and appetizing. An innocent substance which maintains a natural color may be permitted for the same purpose.

If a considerable amount of sulphite is added to freshly chopped meat there results a vermilion tint, decidedly unnatural, and the unpleasant taste of the preservative and the lack of flavor in the meat may at once be detected. This is a safeguard in itself. I have never been able to improve tainted meat by the addition of any substance and it is true, so far as we know, that no preservative exists which will render a spoiled food edible.

As to the studies of the effect of a given diet or given drug in minimum doses on man, the matter is fraught with difficulty.

The very moment a victim offers himself for experiment he is in a susceptible mental condition to exaggerate every sensation. He knows he is receiving a harmful substance, indeed, in Dr. Wiley's recent experiments the drug had to be used in capsule or the subjects lost

appetite. Let a number of men sit at the best repast which the cook's art can produce, and let some one whisper that the food is not as good as it looks, that somewhere there is a lurking poison concealed, or even a hair, and away will go the appetite. Those who are brave enough to eat will take every subsequent peristaltic wave as an omen of evil. We cannot destroy our human victims and examine them postmortem after a given period, and if the danger of food preservatives, properly regulated, is as vague and as insidious as is claimed, morbid anatomy alone would settle the point. Possibly some of those submitting to experimentation may break away from the routine and indulge themselves unwisely; any subsequent illness may be attributed wrongly to the effects of the drug studied. Malingering is a factor, as well as nervous apprehension. Such isolated studies can scarce approach in directness and certainly those upon such animals as dogs.

Much of the work in the direction of animal experimentation has gone for naught because of the full lack of appreciation of the terms of the problem. The conditions under which food preservatives are used are not paralleled in the experiments. Animals so studied should be allowed a moderate amount of exercise. Their lives should resemble the customary life of such an animal. It should not be overfed or surfeited with a drug, but some variety of diet should be permitted, and the proportion of preservative to body-weight estimated correctly, making due allowance for toleration, previously determined by the action of a larger dose.

We even find statements that rabbits have been used as subjects of experimentation to determine the action of a preservative added to meat. An observer along such lines should first determine the effects of carnivorous food on the herbivora. As well feed a man nails and compare his digestion to that of an ostrich.

DISCUSSION.

DR. C. H. LAWALL: In justice to the department of which I count myself one of the factors, I think a few words should be said about the work as we know it. I have been concerned with a few of the cases that have come under the ban of the Law of Pennsylvania, and in almost every instance, when the material was found to be a deception, it was followed by an effort to locate and obtain samples of the dealers who wholesaled the same articles. This is particularly true of soda water syrups. The subject of food preservatives is always open to discussion, and there are two sides to the question. Dr. Coley, whose researches along certain lines entitle him to consideration, has given us one side of the subject. But there is a broader point which has been overlooked by a great many persons; that is, the matter of labelling the products so that the consumer knows

what he is getting. In many cases the consumer cannot know because the label is placed upon the bulk package which the dealer receives, and of which the consumer never gets a sight; this is true of mince meat. Another point is that many manufacturers are in business with intent to deceive. They are driven to this by methods of competition. A case came under my notice, of one of the largest manufacturers in this vicinity in his line in the United States, in which absolute intent to deceive was proven. The manufacturer admitted that it was necessary to use deception in order to make the product look as good as it was required to look. I do not want to pose as a defender of all of the methods of the department, but I do want to be put on record as believing in the honesty and care in analytical work, so far as the individual chemists are concerned. In a certain case on record the fact was brought out that chocolate starch, under certain conditions of heat, was made to assume a condition which caused it to resemble wheat starch, but that experiment was only performed after 3 or 4 hours' careful work, and I don't think it has gone on record as an absolute fact. It has been stated that to cause a prosecution to be based on the mere microscopic findings shows an incomplete knowledge of the subject. It is objected that there is no other method of distinction between these starches other than by the microscope, and that in the absence of any record in literature, that cacao starch resembles wheat starch, there was nothing for the chemist to say but that what he had was wheat starch.

MR. S. S. SADTLER: I do not believe that the mere swelling of the starch granules of the cacao bean will make them identical in appearance with the starch granule of wheat. The wheat starch granule has a peculiar disklike form and it would be inconceivable for it to swell to a sphere. The action of the starch on polarized light would certainly be affected by this swelling or raising process. Carrying out the experiment with a Bunsen burner is quite different from the way the cacao bean is treated by the chocolate manufacturers. I do not see why chemical preservatives are any worse than the same chemical substances found in spices and used as preservatives with universal approval. I am told by a manufacturer of catsup that he could preserve catsup with vinegar but that it would be ill-tasting. On the other hand, it can be preserved with sodium benzoate so as not to be unpalatable and certainly not injurious to health. I think there is no necessity for artificial coloring, and I believe the public can be educated so that it will not demand it. There have not been many carefully conducted experiments to show the danger of preservatives, and it seems to me that a carefully selected commission of chemists, physicians and lawyers, could draw up regulations by which the use of preservatives could be confined within safe and, in many cases, beneficial limits. I am not ready to advocate the use of formalin, but the small amount which would be necessary to preserve milk for a reasonable time would probably not cause as much trouble as bad milk. There is a large number of bacteria in milk, and there might be more danger in using milk containing several hundred thousand bacteria per cubic centimeter than in the use of milk containing one part of formaldehyd in twenty thousand. I think Mr. Smithers's conclusions regarding regulations of laws which should be drawn up are admirable. It seems to me that the dealer should have a sample furnished him and not be subject to all the distressing circumstances that he is today.

People in the grocery business are very bitter about the way in which the laws are administered at present. I think there ought to be recommendations to the legislature on this subject from impartial bodies.

MR. WILLIAM M. SMITHERS: I have been interested in Dr. LaWall's remarks. Every word I said in my paper I have the evidence to sustain. I call upon his own remarks now to sustain the assertion I made, which was that the Food Department chemists are in some instances deficient in their chemistry, are not thorough, are perfunctory and are careless in their work. In regard to the starch granules of the cacao bean, it was said I had not gone deep enough when I spoke of the microscopic test as being the only one used, and the Doctor then proceeded to confirm my remarks by practically telling you that that was the only test. I wonder if he will adhere to what he has said after examining further the works of the German chemists—if he will tell you that the iodin test for the detection and separation of cacao bean starch granules in a mixture of starch granules is not used, and that it cannot be made effective? If so, then I will be prepared to withdraw some of my remarks.

DR. LAWALL: I said that the microscopic examination was the only way to differentiate the various starches. I did not mean the mere recognition of the presence of starch. The iodine reaction, as a differential test, I do not consider one of great practical value. I think that my conclusion that the microscope is the only method is still sound.

DR. COLEY: I think there has been a great amount of unnecessary fear inspired by the Department of Agriculture in the matter of food "adulteration." There has been a terrific agitation about the harm which adulterated foods are doing, and there has sprung up in the minds of the people a fear that they and their children will be poisoned. As Mr. Smithers has mentioned, it is not probable that over 5% of food is preserved. The obscure use of such terms as "adulteration" and "preservation" illustrates the point. A layman speaking of "adulteration" would speak of something capable of doing harm. The chemist might mean that something had been added which might not do harm at all. There is an element of fear on the part of the public that the forces are conspiring against them, and that terror has been increased by the authorities, possibly for political reasons. Our National Department of Agriculture may not be the nonpartisan body that it is said to be. The United States has certain tariff questions constantly pending, and in order to make decisions sound, rational, scientific and plausible, the Department of Agriculture takes a hand and settles whether certain things shall be admitted into this country or not. As Dr. Wiley has said, you can reason to almost any conclusion from the same data. Sometimes it is convenient to reason one way. A man who has an opinion to start with can if he wishes, fit that opinion with the evidence as he finds it. If the public wants to know the truth it must come from the people who have not an axe to grind, and from those who undertake research in a thoroughly scientific way. If there were endowments in our institutions for this purpose, an enormous amount of good work could be done

The Trend of Modern Prescription Writing.

BY M. CLAYTON THRUSH, PH. M., M. D.

[Read October 26, 1904.]

The object of this paper is to show the trend of the physician in his prescribing at the present time. Five hundred prescriptions were carefully examined as they were received and filed in each of two of Philadelphia's best prescription stores, both of which are managed by able and energetic pharmacists, who have had collegiate training.

Five hundred prescriptions were examined in each store in order to make proper comparisons, and also to give a more general report of the type of the modern prescription.

These stores were so located that they received prescriptions from all the leading physicians of the city, and a large number of the prescriptions were from the pens of the professors and instructors on our medical school and hospital staffs, as well as a number from physicians in general practice, so that these prescriptions represent the type of prescription as written by our best practitioners in the twentieth century.

The following table gives the results of my investigation as carried out in two of our best prescription stores; five hundred prescriptions being examined from each store, these prescriptions all being written since January 1, 1904:

1,000 Prescriptions.	Store No. 1.	Store No. 2.	Total expressed in Percentage.
Number containing chemical incompatibilities	8	5	1.3
Number containing pharmaceutic incompatibilities	10	8	1.3
Number containing therapeutic incompatibilities	1	...	0.1
Number containing 6 or more ingredients	34	16	5
Number containing 2 to 5 ingredients	347	371	71.8
Number containing one drug or preparation	119	113	23.2
Number containing only official preparations	244	240	48.4
Number containing proprietary preparations in whole or part.	195	164	35.9
Number containing patent medicines	1	1	0.2
Number in which the metric system was employed	3	2	0.5
Number containing non-official preparations in whole or part .	60	95	15.5
Number written correctly	328	293	62.1
Total prescriptions	500	500	100

Now let us consider these prescriptions under the various headings as classified above:

1. Those Containing Chemical Incompatibilities.—Only those were considered where a dangerous or objectionable compound would

result from dispensing the prescription as ordered (intentional incompatibilities not being considered), and we find eight in the one series and five in the other.

This is a good showing, but it would have been far better if there had been none, as in some instances the prescriber had to be notified and the prescription altered, in others a "shake well" label would suffice to obviate possible danger.

This shows two things: first, the importance of having our prescriptions compounded by competent pharmacists, who have a thorough knowledge of chemistry, and who can act as a "safety valve" when dangerous compounds are ordered, either through oversight or ignorance on the part of the prescriber. Second, the importance of every physician having a general knowledge, at least, of chemical combinations, and how to intelligently combine drugs in order to obtain the best results without forming dangerous compounds.

2. Those Containing Pharmaceutic Incompatibilities.—As in the first group only those prescriptions were classified which were particularly objectionable or unsightly in appearance, nauseating in taste or difficult to dispense as ordered. Here we obtain ten from the one store and three from the other. It has been frequently said that if a physician had to take some of the "potions" that he orders, there would be a radical change in modern prescription writing.

This heading is of particular importance to the pharmacist, as it is his duty to dispense as elegant and palatable preparations as possible.

Every medical school should give a complete course in prescription dispensing in the pharmaceutical laboratory, as this knowledge would be of inestimable value not only in framing elegant combinations, but of especial service to the country practitioner who is compelled to compound his own medicine.

3. Prescriptions Containing Therapeutic Incompatibilities.—Only one prescription was found that was particularly antagonistic from a therapeutic standpoint, and this shows that the average medical student is more thoroughly trained in therapeutics than he is in pharmacology.

4. Prescriptions Containing Six or More Ingredients.—Thirty-four out of the one series and sixteen in the other contained six or more ingredients, and a noticeable fact was that certain physicians wrote the great majority of these prescriptions, there being a great tendency on the part of certain physicians to drift into polypharmacy, but it is pleasing to note that this tendency is gradually dying out,

and we hope that the day is not far distant when the old "shot gun" prescriptions, of from twelve to fifty ingredients, will be framed as curiosities of by-gone days.

Another noteworthy fact is that these prescriptions are mostly written by the very old practitioners. If this improvement had only occurred years ago, homeopathy would not have gained its present foothold; then again the system of prescribing as used in our best hospitals is so designed as to use single drugs or preparations, and to make these as elegant and palatable as possible—a good step in the right direction.

5. Prescriptions Containing Two to Five Ingredients.—This constitutes the great majority, almost three-fourths of the prescriptions, and shows a great improvement over the prescription of a century ago, when it was the popular belief that the greater the number of ingredients the greater the chance of cure.

This rule would apply where ignorance in diagnosis exists, as by this theory the greater the number of ingredients present the more likelihood of administering something that will be of service, a good example being the old Warburg's tincture, the original formula as directed by Dr. Warburg containing the old *"confectio damocratis,"* this being a complex astringent confection containing opium, and which originally had sixty-four ingredients, many of the constituents being unobtainable at the present day.

6. Prescriptions Containing One Drug or Preparation.—It is pleasing to state that the greater number of these prescriptions were written by our most able practitioners, men who are prominently connected in medical teaching, and while they do not represent quite one-fourth of the total number, this is not a bad showing.

7. Prescriptions Containing Only Official Preparations.—Approximately one-half belonged to this group, and you will note the slight variation in this respect in the two series. This is likewise encouraging, and may the day be not far distant when the number will be increased still more. A point of interest observed here was that the more educated the physician the greater the use of the United States Pharmacopeia, and why not?

8. Prescriptions Containing Proprietary Preparations in Whole or Part.—One hundred and ninety-five of the one series and one hundred and sixty-four of the other, about 36 per cent, contained proprietary preparations or, in other words, more than one in three prescriptions.

This is a good showing when we consider that the manufacturing chemists employ persuasive salesmen, who visit every doctor's sanctum at stated periods and present him with a liberal supply of their *"ideal"* preparations, which are always superior to any other make, and which are usually combined by a *"peculiar"* chemical process that enhances their therapeutic activity.

9. Prescriptions Containing Patent Medicines.—Only two of the prescriptions were for patent medicines, and one of these was written by an "osteopath," so that we are only responsible for one, and this was one too many.

How any regularly qualified practitioner of medicine could so disgrace himself and his profession as to order patent medicines is beyond my comprehension.

10. Prescriptions in which the Metric System was Employed.—Only three of the one series and two of the other demonstrate the fact that the metric system is but little employed at the present time, and its use does not materially increase, as my own experience in the retail drug business for a number of years corroborates.

One fact is observed, that when a practitioner uses the metric system, he uses it exclusively. It is to be regretted that the profession does not adopt this system and use it exclusively, as it is simpler, more scientific and in every way preferable to our present system of weights and measures.

The leading medical schools give their students a thorough training in this system, and teach how to convert the various denominations into the English system and *vice versa,* but after leaving the college halls this is all thrown aside.

11. Prescriptions Containing Non-Official Preparations in Whole or Part.—In this group are classified prescriptions containing commonly used preparations which are not recognized by the United States Pharmacopeia, but which can be prepared by any pharmacist, such as the elixir of iron, quinine and strychnine, and in this group we have sixty in the one series and ninety-five in the other, showing considerable variation; a noteworthy feature being that the series that yielded a large number, thirty-four, of the polypharmacy type of prescription, yielded the small number, sixty, of this type, while the other series that yielded sixteen of the former yielded ninety-five of the latter. A proportionate comparison.

12. Number of Prescriptions Written Correctly.—The criticisms in prescription writing applied to the endings used in designating the

drugs or preparations and the use of the proper official names as embodied in the inscription, and the proper phraseology as applicable to the subscription.

As a rule, the prescriptions of the teaching class of practitioners were correctly written to a great extent, while those of some of our regular practitioners were carelessly written on the one hand, and others showed a marked defect in the knowledge of prescription writing.

This was especially noticeable among the prescriptions of the more recent graduates.

Less than two-thirds were correctly written, and this is largely due to the efficient training in this important subject in the average medical school.

Several of the prescriptions were written by a young practitioner who received the highest average among four hundred men at a recent examination of the State Medical Board, yet every one of his prescriptions showed errors in writing and in combining drugs. This merely shows that his training was deficient in this important subject.

Now who is responsible for this deficiency? Is it the teacher, the means at his command and time allotted for teaching the subject, or the student, that is at fault? The teacher is often a physician who has never received any practical pharmaceutic training other than the "smattering course" that he received as a medical student, and, as a rule, on account of limited training and lack of interest, he follows the same rut as his predecessor; as a consequence, the pharmaceutical laboratory is deficient in its equipment and very unattractive.

Because of these facts, officers and trustees are impressed that this branch of medicine is unimportant, and the student not realizing the value of a pharmaceutic training, completes the course ignorant of its many valuable points, and usually not until he reaches the senior year and commences to prescribe, does he fully realize his deficiency in the knowledge of the mode of preparation, appearance, administration and effects of combining drugs, the very ammunition he is to use in firing his gun of knowledge to combat disease. It is not, however, until as a physician, authorized to use blank and pencil, and brought face to face with the patient, that he most seriously and keenly feels the sting of his pharmaceutic ignorance; tries to formulate a palatable mixture and fails, expects to find a nice clear solution when he calls, only to find one with an unsightly and often dangerous precipitate. It is now after repeated failures that the horizon is

filled with attractive-looking proprietary preparations, and these are substituted for the official drugs, and merely because the label states that they are specific for the disease under consideration. As a result this habit once established is continued through life.

Three of the above prescriptions were written by "osteopaths" and they all showed utter ignorance of the first principles of prescription writing.

This should be a warning to us, for if they should receive recognition in the various States they will attempt to prescribe medicines and treat all diseases, not limiting themselves to their own particular methods. The medical profession should be aroused to this matter and take action before it is too late.

In the past few months several scathing editorials have appeared in the daily press relative to the large number of incompetent practitioners who are turned out by our medical schools, and the State Board suggests an investigation of the present methods of teaching and the adoption of a more comprehensive curriculum.

However, in looking over the examination results of the various State boards as compiled in the August 13 number of the *Journal of the American Medical Association,* we find that the percentages of failures from the Philadelphia medical schools vary from none to 8.6 for the year 1903, and this was the most satisfactory showing of any State in the series, when you consider the number of students examined. The total number of candidates examined in the thirty-seven states was 5,027. They represent 157 American colleges, eight Canadian institutions and there were some representatives of foreign schools. Of the whole number examined, 4,312 passed and 715 failed. The percentage of failure was 14.2, but of the Philadelphia students only 5.48 per cent. were found wanting.

This was a lower percentage than was shown by any other state or by the outsiders. The percentage of failures from New York was 7.12; of Boston, 7.28; of Chicago, 8.18; of Washington, 18.84; of Baltimore, 22.70; of Louisville, 27.67, and of St. Louis, 32.67. Another remarkable showing is that of the 4,312 successful candidates 9 per cent. were from the Philadelphia schools and only 3.2 per cent. of the 715 failures can be charged to this city. These figures demonstrate conclusively that the medical training given by the Philadelphia schools is thorough and comprehensive. Again, at the recent examination of a State medical board the following are two of the questions asked under materia medica:

1. Name the drug of which pilocarpin is the active principle, and give the dose of the tincture that would be equivalent to $^1/_{20}$ grain of pilocarpin.

In the first place there is no official tincture of pilocarpus, and hence no recognized tincture of definite strength, and the majority of our standard medical works do not mention any strength for the tincture, and those that do show a variation in strength, so that this question is unanswerable. Books like those of Remington, Caspari, Coblentz and United States Dispensatory on pharmacy, and Shoemaker and Potter on materia medica, do not mention any strength for the tincture, and, granted that the strength was given, the yield of alkaloid varies from ¼ to 2 per cent in different lots of the drug, as all the books state; therefore, how in the world can a student answer such a question?

2. Give the dose of tincture of nux vomica equivalent to $^1/_{30}$ grain of its principal alkaloid, and name two official preparations into which this active principle enters.

This is a more desirable question, but even here very few students can remember the strength of the tincture as indicated in the United States Pharmacopeia, and for the second portion of the question, a number of the students gave the salts of strychnine instead of the preparations asked for.

After conversing with a number of the candidates as they came from the examination room, I found that not a single one answered these questions correctly.

If the medical boards desire less failures, let them ask: first, questions that can be answered; and second, questions that when answered are of some practical value, and not unanswerable and unusual questions that no one could answer intelligently, even if he had access to the text-books. The object of State examining boards is to determine the fitness of candidates to practice medicine and surgery, and this can only be done by asking practical and useful questions that every well-educated physician should be able to answer intelligently, and not by asking unanswerable or unusual questions, the knowledge of which would be of no practical value, and questions which examiners could not answer themselves without consulting the proper books.

The above investigation warrants the following conclusions:

(1) That the trend of modern prescription writing is in favor of proprietary preparations.

(2) That the use of polypharmaceutic preparations is diminishing to a great extent, and their use is chiefly confined to the older practitioners.

(3) That the number of incompatibilities observed is greater than it should be.

(4) That the metric system is but little employed at the present time in prescription writing, a condition to be deplored.

(5) That over one-third of the prescriptions are incorrectly written, and this is especially noticeable among the younger practitioners.

(6) That certain non official preparations are quite popular, and some of these deserve admission to the United States Pharmacopeia.

(7) That the more educated the physician the greater the use of the pharmacopeial preparations, and the greater the tendency to simple instead of complex, nonscientific, polypharmaceutic and proprietary preparations.

DISCUSSION.

DR. HENRY BEATES, JR.: As a representative of this body and the profession on the Medical Examining Board, I desire to congratulate the reader of the paper on his frank criticism of the relatively valueless and nonsensical questions which occasionally, in spite of the best efforts to prevent, will be incorporated in the examination papers, because of the manner of adopting the questions, which must conform with the especial requirements of the Act of Assembly. Referring to the 2 questions, which, it is self-evident, are not capable of being answered correctly, had the author of the paper inquired a little further of the candidates with whom he conversed after leaving the examination room, he would have ascertained the fact, that it had been my unpleasant duty to inform the candidates, that if any gentlemen were unfortunate enough to fail, and that failure was due to the answer that had been recorded to the 2 questions referred to by the author of the paper, they would have been accorded a passing mark. I mention this fact to show to you that the administration of our law, by the Board, is directed as much against its own shortcomings and defects, as it is employed in the interests of the profession which it has the honor to represent. If every member of the profession would take as much interest in the standardizing of medical education, as the writer of this paper has done, we would have less difficulty in bringing about that condition of affairs which would make this disagreeable criticism impossible, and enable us to place upon a proper foundation the entire mechanism necessary to supply to the community competent and qualified physicians. I am glad to know that the schools of Pennsylvania, in comparison with other medical schools of the United States, have done relatively so much better than they. This relatively high standard, however, should not be the occasion for discontinuance of efforts to elevate still further what must be recognized as an inadequate condition of medical education. Pleasing as these results are,

the question may pertinently be asked, "Why is it that the schools of Pennsylvania stand relatively superior to those of the other States?" The necessary answer must be, in all honesty and sincerity, because of the fearless and impartial administration of that law, governing the practice of medicine, the adoption of which was largely due to the efforts of this Society, in its behalf. That law has compelled those colleges, which otherwise were not so doing, to so improve the standard of their work, that these commendable results can be recorded. With all these improvements, the actual demands of professional qualification still find the standard far from what it should be. I hope every physician representing this body will aid in the establishment of higher standards, so that Pennsylvania can, in the very near future, boast of an unquestioned and thoroughly established proper medical education.

DR. S. SOLIS COHEN: I should like to ask the reader of the paper a few questions. First, what is meant by "therapeutic incompatibility?" I have in mind a prescription that many members of this Society occasionally write, of aconite and digitalis together. These are to a certain extent antagonistic and yet they may under some circumstances wisely be given together. What is the criterion? And who is to be the judge, the physician who knows the case and patient, or a critic knowing neither? Also, I should like to know whether in counting 6 or 7 ingredients against "the old-practitioners," whether water and syrup and flavor are counted, because, if so, there are 3 ingredients, not properly termed drugs. Or in some cases it may be necessary to resort to pharmaceutic expedients. For example in a formula for which I am originally responsible, and which has been imitated by at least 2 proprietary preparations, *liquor ammonii citratis* of the British Pharmacopeia and an excess of citric acid are used to prevent precipitation of the iron in a mixture of sodium salicylate solution and tincture of ferric chlorid. There are 2 medicinal ingredients in this formula but if the alcohol of the tincture and the water of the ammonium citrate solution were counted it would make 6—if sodium and salicylic acid, iron and hydrochloric acid, ammonia and citric acid are counted separately there are 12. Add glycerin to make the mixture smooth and oil of wintergreen as an appropriate flavor, behold 14!—that is, if you write your own prescriptions. But adopt a descriptive or proprietary name, pay no attention to pharmaceutic detail—order the same medicine as *mistura ferro-salicylata*, the name I attached to it in the house pharmacopeia of the Philadelphia Polyclinic, where it was first prescribed, or the similar names adopted by manufacturing firms for the imitations and there is a prescription of a "single preparation!" Perhaps the reason why elder practitioners write more lines in their prescriptions is that they use their own brains and their own pharmaceutic knowledge, while we younger men—or perhaps I am now to be counted among the old men, too—depend more on the pharmacist. But more lines in the prescription, as I wish to emphasize, do not necessarily mean more ingredients, but often more knowledge, more experience, more care, more skill in combination and in prescription-writing. Another line on the table refers to prescriptions for "one drug or preparation." One drug, we understand: one preparation again, like Basham's mixture or an elixir of quinin, iron and strychnin or the hypophosphite preparations of complicated formula may contain many ingredients, in the latter instance many more than the 14 that could be counted in mistura ferro-salicylata, or the 6

probably counted. Now if by "one preparation" this table means a preparation of complex formula, the comparison is not between simple and complex prescribing, but between devising your own prescriptions or letting some one else devise a combination and then using it by "one" name. If this be the case, the comparison intended by the author of the table fails. Again, I should like to know what is meant by "proprietary preparation" as used in this table. Few physicians understand the true meaning of the term "proprietary preparations." Squibb's ether is a proprietary preparation, and "antikamnia" is a proprietary preparation, and Churchill's hypophosphites is a proprietary preparation. Yet there is a considerable difference to be noted as to these 3. Ether is not secret. Hypophosphites is not secret. Antikamnia is secret. It is perfectly proper to specify Squibb's or any other manufacturer's ether or hypophosphites and it is absolutely evil to prescribe antikamnia or any other secret preparation. If these 2 or rather 3 classes that is the simple proprietary—Squibb's ether—the complex proprietary—Churchill's hypophosphites—and the secret nostrum—antikamnia—are lumped in the table, it is again misleading. The secret preparations are preparations of which the composition is withheld. They cannot be tested by any known standard, and no one who respects himself or science or the welfare of his patient can possibly use them knowingly; yet they are used daily by reputable physicians through misunderstanding of the difference between secret and nonsecret proprietaries—a misunderstanding industriously cultivated by those who wish to sell 10 cents' worth of stuff for $1.00 by pretending that it is other than it is. I should be sorry to think that in 1,000 prescriptions from our leading drug stores, written by the leading practitioners of the city there were anything like 359 containing these abominable and dangerous secret preparations. On the other hand the specification of Squibb, or Rosengarten, or Paraf-Javal, or Parke, Davis & Co., or Armour or Schering or Merck or Fairchild or any other manufacturer of some legitimate specialty desired, is perfectly right. I do it daily. The table, then, should discriminate between proprietary and secret preparations. A "patent medicine," I suppose, refers to medicines which above all things else avoid the attempt to obtain a patent; namely, the class of secret nostrums advertised to the laity. I am sorry that we have even one to our credit. As to the writing of a prescription correctly, that is a difficult thing to determine. A prescription in which drug names are abbreviated, for example, *Hydrarg. chlor. mit.*, or one written partly in Latin and partly in English is not, strictly speaking, written correctly. Yet, I doubt whether any of us takes the trouble always to write *Hydrargyri chloridi mitis* in full—I use the genitive—or to write the directions for the patient in Latin. I once undertook to write certain important pharmaceutical directions in Latin, but I found that some druggists would have to send to me for translation, so that I have gotten into the habit of writing pharmaceutical directions of any importance in English, which moreover is easier as my Latin terminations are getting rusty. I believe it would be much better if we should habituate ourselves to write the whole prescription in English, using accurately the accepted chemical terminology. Going back to one of the more important issues raised by this analysis, that concerning the inferiority of socalled "polypharmacy," to the use of a single drug, there is a very large therapeutic question which cannot be settled offhand. If the single drug is the thing that the patient needs

to help him to get well, that is the thing to prescribe. If it is not, a single drug is one too many. If it is desirable to add a purgative to a prescription which is intended primarily for some other purpose; or if it is necessary to counteract undesirable by-effects of one preparation by another as in the combination of morphin and hyoscin or morphin and atropin; or if it seems desirable to reinforce one drug by another or 2 others of similar action instead of using a large dose of any one, as in the combination of digitalis, spartein and strophanthus; or if it seems necessary to avert gastric irritation by a pepsinated vehicle, as in the use of such a vehicle for sodium benzoate or potassium iodid in large doses; or if it is necessary to make a prescription more palatable by the addition of a flavor or an elixir; or, if it is necessary, as in the mixture of iron and sodium salicylate already cited to add citric acid and ammonia water in order to maintain solution; there can be no objection to these types of "polypharmacy," even if the ingredients (counting water, etc.) number 5 or more. I believe that the author has brought before us a very important practical subject and we are much indebted to his industry; but the tables in their present form are misleading in the respects pointed out.

DR. THRUSH: In reply to the questions submitted by Dr. Cohen, I would state, that in this paper it was my intention to bring before the Society the type of prescription that is being written at the present time, and also to show how they average in regard to the number of ingredients present and as to incompatibility. By therapeutic incompatibility I meant the combination of those ingredients which from a therapeutic standpoint were directly antagonistic, and in which the action of the drugs would be particularly antagonistic when administered in combination. I came across 2 instances in which 2 such ingredients as aconite and digitalis were used, but I felt that it was done for a certain object, hence I did not consider these in my classification. My mention of 6 or more ingredients was to show the large number of prescriptions containing 6 or more ingredients in their composition. Each drug or preparation is considered as an ingredient. In order to make the proper classification I must consider in these prescriptions that the water would count as an ingredient, also the syrup and other vehicles used. The questions of proprietary preparation is a question considerably confused in the minds of all. I mean by the term proprietary those preparations of which we know the chemical or pharmaceutical composition, but which are dispensed by some particular chemical manufacturer, who has a copyright for that particular preparation, and which no one else can legally prepare, such as "phenacetin," "dermatol," "adrenalin chlorid," etc. By "one drug, or preparation" I mean an official drug of the Pharmacopeia, or a common preparation, such as the syrup of the hypophosphites, in which several ingredients are used in its preparation. By "patent medicines" I mean secret medicines in which the composition is unknown, such, for instance, as Lydia Pinkham's Vegetable Compound. In regard to prescriptions being written correctly, "Basham's mixture," for instance, is not the correct official name, therefore in all cases in which the official name was not used, that was considered an incorrect way of writing In regard to the subscription, the same point was considered. In regard to the directions, usually the physician writes them in English, and that is understood to be the correct way in this country. In the use of the English names in prescription writing, the patients know what they are

taking, and in some instances that would be undesirable. A prescription in the Latin language is the same throughout the whole world. Many physicians write "Please copy prescription on label," which has certain advantages, but in a great many instances it is particularly objectionable. When I was in the retail drug business I found that a prescription with the copy on the label was sent all around the neighborhood and that many a fee would be lost to the practitioner.

An Unusually Severe Case of Acute Chorea Successfully Treated with Apomorphin.

BY MONTROSE GRAHAM TULL, A. M., M. D.

[Read January 11.]

In apology for presenting a remedy for a most troublesome affection, based upon my experience in a single case, I can only say the surrounding circumstances were so peculiarly definite, the clinical picture so distinct and perfect, the endorsement of the diagnosis by a specialist of high standing so valuable and the result so prompt, well defined and, above all, so satisfactory, that I feel justified in reporting the case at some length.

Elizabeth B., aged 15 years, consulted me in the spring of 1904. She was an overdeveloped girl, presenting the physical appearance of a more mature woman, but was of neurotic stock; a maternal aunt having had chorea in an aggravated form when a girl. Her menstrual periods had appeared a year previous, but had not been regularly established. She, although a Protestant, had been sent to a Catholic school, and as a result of the general strain on her nervous system began to show signs of chorea. I at that time advised some changes in her school regimen, put her on the usual treatment of arsenic and iron and advised an abundance of outdoor exercise. In spite of this she rapidly grew worse and had to be taken from school. On May 1, 1904, I was sent for to see her at her home and found the choreic and general symptoms much more pronounced. She soon was entirely unable to stand or walk. The condition rapidly degenerated into an acute mania, with thickened tongue, guttural and unintelligible articulation, the lips being covered with a thick tenacious mucus. A confluent morbilliform rash extended from head to foot, covering the entire body, trunk and extremities. She was soon a mass of bruises and had to be surrounded with bolsters to prevent her seriously injuring herself by contact with bedstead and walls. A trained nurse and her mother were with her constantly day and night. During this period I made use of all the accepted remedies, giving her at various times 10-grain doses of veronal, large doses of strontium bromid, the three valerianates, opium by suppositores, and finally a pill containing morphin acetate, ⅛ grain; camphor, 1 grain; English extract hyoscyamus,

1 grain; and creosote, ⅛ grain, every 1, 2 or 3 hours, *pro re nata*. This was in addition to arsenic in ascending doses, which had been exhibited from the beginning. After many days of this treatment, not only without a sign of improvement, but with a steady retrogression, I became alarmed for the patient's life, and called in my friend Prof. Charles S. Potts, who unhesitatingly pronounced it the most severe case of chorea that had ever come under his observation. He suggested rapidly increasing the arsenic to 16 drops, t. d., which was done at once with no apparent benefit. On the evening of the day following one of Prof. Potts' visits we were all in despair, the mother insisting that something be done to at least give relief from the spasmodic movements which had continued, without intermission, for 2 weeks. I was ready to throw down my hands and confess myself completely baffled, when my somewhat familiar experience with apomorphin in alcoholic delirium occurred to me, and as a last resort, I concluded to try it in tentative doses. One-fortieth of a grain of apomorphin was administered hypodermically with results as gratifying as they were surprising. Within probably three minutes the incessant motion had ceased, the muscles were relaxed and the child slept peacefully and quietly. I then ordered 1-20 grain by the mouth every 3 hours with the arsenic continued as before. At no time was there sign of nausea or vomiting. The result was all that could be desired; a steady, gradual improvement with no return of the severer symptoms Ten days later the patient was able to go to Ocean City, New Jersey, where she spent the entire summer in good health.

The case seems to be of special value, in that the earlier treatment was reviewed and endorsed by a skilled expert, who at the same time confirmed the diagnosis and testified to the unusual severity of the attack.

It was extremely gratifying after all our efforts had proved abortive to find ourselves rewarded by an immediate success, from a remedy which, so far as our knowledge extended, had not previously been used in this disease.

This of course is but a single case, yet it has often seemed to me that the old maxim, that a chain can only be as strong as its weakest link, should be made to read that a chain ought to be, and should be made as strong, as its strongest link. Applying this to medicine would be equivalent to claiming that a clear, definite, unequivocal result in one case should be duplicated in all of the same type, and this would necessarily follow, were it not for our faulty application of remedial methods. I most sincerely trust, however, that in this instance, our results may be repeated and our conclusions confirmed by the experience of others along the same line.

Before leaving the subject, I may be pardoned for saying a word or two concerning the permanency and general reliability of apomorphin as a pharmaceutical product. My experience with it has been

considerable, as in addition to its more common use in the delirium of acute alcoholism, with which you are doubtless familiar, I have for the past two years used it exclusively in the treatment of capillary bronchitis and the bronchial catarrhs of childhood with most satisfactory results.

Its physiologic effects have manifested themselves in a marvelously short time. I have never seen it fail to turn water a bright green color when in aqueous solution. This result is so positive that I always forewarn the mother, that she may not be needlessly alarmed by the reaction.

In doses of one-tenth grain, hypodermically, I have never failed in producing emesis within five minutes, and I have used it for this purpose in alcoholic cases many times during the past ten years.

In doses of one-two hundredth, to one-one hundred and fiftieth grain by the mouth to children, I have observed nothing more than a condition of general relaxation followed by very pronounced hypnosis, which is also very markedly present after the exhibition of large doses.

Its effects recall Professor Horatio C. Wood's characterization of veratrum viride as bleeding a man into his own vessels.

The pallor, cold sweat and profound collapse seen after the ingestion of large doses are very alarming, yet I have learned to look upon them as upon a similar condition following the use of tobacco by one unaccustomed to it, decidedly more terrible in appearance than dangerous in reality. I believe that the general relaxed condition of the vascular system so relieves tension as to remove all chance of cardiac insufficiency. As a matter of fact I have always found the pulse full, regular and soft, with deep and undisturbed respiration, notwithstanding the apparent great prostration.

In two cases, which I have seen, profuse bowel movements have followed the administration of one-tenth of a grain hypodermically, but this would appear to be exceptional.

I am quite sure that we have in apomorphin, a much neglected and undervalued drug, most powerful in its therapeutic action, but in intelligent hands a perfectly safe agent. Taking everything into consideration I know of no remedy upon which I have learned to rely with more confidence than upon this, and I now feel quite at a loss when it is not present in my hypodermic case.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

Report of the Annual Business Meeting.

[January 18.]

The following is an abstract from the reports of the various officers and committees submitted to the Society at its annual business meeting:

The Secretary reported that there were 902 members at the beginning of the year 1904. One hundred and thirty-nine new members qualified during the year. The Society lost fifteen members by death, six by resignation and eight by forfeiture; leaving a total of 1,012 members at the close of the year.

The Treasurer reported that he had, on January 9, 1904, a cash balance of	$1,126.61	
There was received during the year for fees, dues and fines	5,753.10	
From the Chairman of the Publication Committee for the year 1904	102.80	
Interest on deposits equaled	37.72	
		$7,020.23
The general expenditures were	$4,670.07	
Transferred to the Medical Defence Fund	494.50	
The balance at the close of the year was	1,855.66	
		$7,020.23
There was in the Medical Defence Fund on January 9, 1904, a balance of	$313.00	
There was transferred from the General Fund	494.50	
Contributions were received to the amount of	35.00	
Interest on deposits equaled	10.55	
		$853.05
The attorney for the Society received		100.00
The balance at the close of the year was		$753.05

The Directors recommended the following appropriations for the year:

Rent of halls for the Society	$240.00	
for the Branches	160.00	
		$400.00
Printing notices of meetings, bills, etc.		500.00
Postage and stationery		100.00
Certificates, engrossing, etc.		60.00
Bonding Secretary and Treasurer		20.00
Auditing Treasurer's accounts		20.00
Director's expenses		50.00
Collector		40.00
Medical Society of the State of Pennsylvania, assessment on 1,050 members (estimated) at $1.50 each		1,575.00
Medical Defence Fund, 50 cents for each of 1,050 members (estimated) — including attorney's fee		525.00
Treasurer's clerk		50.00
Secretary's salary		300.00
Publication Committee—including cost of publishing the Proceedings of the Society, the salaries of the Editor and the Stenographer		1,500.00
		$5,140.00
The income of the Society for fees, dues, etc. is estimated at		5,247.70
So that there would be a balance for the year of...		$107.70

The Publication Committee reported that Volume Twenty-five of the Proceedings was issued during the year 1904. The volume consisted of 324 pages, and contained 50 papers with their discussions. The total cost of the volume was $1,457.68

The receipts for advertisements, etc., were..... 146.65

The net cost of the Proceedings for the year was.. $1,311.03

The Practice of Medicine in India.

BY ANNA M. FULLERTON, M. D., Ludhiana, Punjab, India.

[[Read by Invitation, January 11.]

The practice of medicine in India (at least in the portions of the country which are entirely native in their environment and customs) cannot be said to be alluring to the purely scientific physician. Almost insurmountable obstacles to the achievement of professional success are offered by the social conditions of the country and the grinding poverty of the mass of the people. A fanatical adherence to ancient customs and religious beliefs defies the laws of science at every point.

One who has lived in India and learned to know its people, is not surprised that years of strenuous effort on the part of the English Government have not sufficed to suppress the terrible epidemics of cholera and plague which decimate the land. The European officials there do not dare to live within the precincts of a native city. What is known as the European settlement is usually two or three miles away from it. Here the foreign officials build their homes, protecting themselves, so far as possible, from prevailing diseases, by modern methods of sanitation. Mission work, however, must be carried on nearer the place of need, hence we find all mission institutions established close to or within the walls of the native city. Tourists, for this reason, often fail to come in touch with missionary enterprise.

The streets of Indian cities are thronged with cases of remediable disease which, through neglect or improper treatment, have become irremediable—women maimed for life through brutality; little children, hopelessly blind, deaf or disfigured for lack of care. Disease is, of course, of much more frequent occurrence in a land where no knowledge of preventive medicine exists; and where the superstitions of the people and their barbarous religious practices are at the root of much of the evil. The symptoms of disease are usually also seen in a much more aggravated form.

Scurvy, diarrhea and gangrene, the result of chronic starvation, abound. It is a well-known fact that one-fifth of the population (about 60 millions) are insufficiently fed, even in ordinary years of prosperity. A large number of the people can obtain but one scant meal a day. According to the last census, there are nearly 300,000,000 people in the country. A few "nabobs" and "rajahs" have enjoyed the possession of immense treasures, but the people, as a whole, grovel in the lowest depths of penury and want.

The average income of the common laborer in India is between four and five rupees, or $1.50 per month.

The inhabitants of the land are a rural people. Nine-tenths of the population are said to live in towns of less than 5,000 inhabitants.

Famines are of frequent occurrence and constitute a most perplexing evil. These must continue to menace the country so long as people, weakened by hunger and disease, must strive to wrest their food, by means of artificial irrigation, from a land parched by frequent droughts.

Plague, the eruptive fevers and pulmonary diseases, including tuberculosis, are especially prevalent and fatal during the rainy seasons and winters—when the people must crowd into their close, filthy homes (occupied in common with their domestic animals, as cows, buffaloes, goats, etc.) in order to escape the inclemency of the weather.

Dysentery, cholera and other intestinal affections with fevers, chiefly of malarial type, are the scourges of the long, hot seasons.

Manifestations of demon-possession are among the curious phenomena not infrequently met with. These appear to be but aggravated forms of hysteria, the result of the terrorism induced by the belief in the existence of cruel and vindictive gods, who are ever seeking to do them hurt.

Fortune-telling by omens and astrology is constantly resorted to, and adds to the state of dread in which the average Hindu lives. Let a lizard fall from the ceiling on his head, and he fears death; if it fall on his nose, disease. If an ass brays in the east, success in his enterprises will be delayed; if in the southeast, death is imminent; if in the west, some disturbance will occur. Sneezing and the howling of dogs forebode evils tidings.

Surgical diseases and accidents are most common. The performance of surgical operations, however, is consigned to the barber. His resources are limited to blood-letting, the application of leeches or the use of the actual cautery.

For tumors, ovarian, fibroid and malignant, he can do nothing, hence one meets with immense growths, accompanied often by complications which preclude successful treatment. When the fear with which all surgery requiring the use of the knife can be overcome, the "foreign doctor" may win for himself undying fame by his achievements in this line of work. Because of an entire disregard of surgical cleanliness, the number of cases of wounds in which worms are bred is very great.

Skin diseases, including leprosy and the cutaneous manifestations of syphilis, are very common.

There is no proper system of medical practice among the people themselves. Herb-doctors, called "hakims," vaunt themselves in every community and combine with their practice priestly chants and incantations, with offerings to the gods.

But, perhaps, I have told enough to prove that one who would practice medicine for the benefit of India's millions, must be *philanthropist* and *educator*, as well as *healer*. I should like, however, to speak of the needs of India's women. According to the last census, there are about 120,000,000 women in India. Of this number 50,000,000 are zenana prisoners—the high caste, secluded women, to whom male physicians can never have access. Only through the medium of ignorant, untrained midwives can these poor women be cared for. This fact, combined with the practice of child-marriage, is a source of suffering, the extent of which cannot be computed. Brahmin girls must be married between the ages of seven and eleven.

It would be impossible to give an adequate idea of the tragedies in this connection, with which a woman physician meets—the shocking mutilations which often render repair of any kind impossible. The prevalance of rickets and scrofula among Hindu women, is thought to be largely due to the custom of early marriage, for the demands of maternity are made upon a system in which the bones and other tissues are not yet fully developed, hence the offspring is insufficiently nourished and that at the expense of the mother

Sir John Strachey says, with regard to the custom: "It would be difficult to imagine anything more abominable than the frequent consequences of child marriage, by which multitudes of girls of ten or twelve, or less, are given over to outrage; or, if they belong to the higher class of Hindus, are doomed to lives of degraded widowhood." Another writer says: "The Indian government has endeavored to remove this evil, but at all points it has been opposed, not only by conservative orthodox Hindus, but also by educated members of the community. One of the consequences is that girls of even twelve years are known to become mothers in that land, while very few attain the age of eighteen without bearing children. An increasing population under these physical conditions cannot be a healthy or a vigorous one."

In my own experience in gynecologic work in India, I have found hat it is the tendency of these early marriages to make women sterile.

The first conception often terminates in a miscarriage. Superinvolution of the uterus often follows the first birth or the first miscarriage, and renders subsequent impregnation impossible.

The children who are born to these immature mothers are weak and puny, and females rather than males. This gives rise to much domestic unhappiness, as every Hindu must, if possible, leave a male heir. If his first wife does not present him with a son in seven years after marriage, he may take another wife every succeeding seven years, until a son is born.

The English Government has made noble efforts to provide suitable medical aid for the people, by establishing hospitals and dispensaries in the largest towns. Medical colleges have also been erected in such cities as Calcutta, Bombay, Agra, Lahore and Madras. In these institutions native men and women who have sufficient education, may be trained for medical service. Three grades of workers are trained: Hospital assistants, assistant surgeons and bachelors of medicine. Hospital assistants are expected to act as superintendents of hospitals or dispensaries under the supervision of an assistant surgeon, or of the European civil surgeon in a station. Major operative work is expected to be done by the latter. Civil surgeons (chiefly Europeans) are assigned to every large city—especially those having any European residents. For the amelioration of women, special hospitals have been established in many towns. These are called "Dufferin Hospitals" in honor of Lady Dufferin, the wife of a former Viceroy, who was instrumental in starting a fund for the purpose.

Unfortunately the majority of these institutions are superintended by Hindu and Mohammedan medical assistants, who retain the caste prejudices and religious superstitions of their people, and who have not the moral qualifications for positions of trust. Low caste people or outcasts fare badly at their hands. Government hospitals exclude religious teaching from their wards, and this, we feel, weakens their power for good among a people so intensely religious as the Hindus are, for it prevents the effort to introduce reforms which are dependent upon the overthrow of the religious superstitions of the people.

Religious fanaticism circumvents the efforts of the English Government to stamp out plague, cholera and other filth diseases.

The dense ignorance of the mass of the people and their indescribably filthy habits of life, can only be combatted by patient, disinterested methods of teaching them and lifting them out of their

degradation and misery. It is the employment of such methods that renders missionary enterprise so helpful and so efficient in foreign lands. It is told of Darwin, that after visiting Terra del Fuegos, he told the missionaries laboring there, that they might as well pack up their things and return to their native land, for the people of the place were too degraded to be benefited by their ministrations. Some years afterward, so marked did he find the change in the Terra del Fuegans to be, that he sent a donation of twenty-five dollars to the secretary of the missionary society laboring there, and kept this up as a yearly contribution until the time of his death.

One of India's greatest statesmen, Sir John Laurence, has said: "In my judgment Christian missions have done more real lasting good to the people of India, than all other agencies combined."

Mission hospitals and dispensaries are scattered at various points, throughout the country, and are really doing more than almost any other institutions to bring Western ideas into favor with the people. The crying need is for more helpers in this field, and more means.

A most important institution is the Medical School for Women at Ludhiana, in the Punjab, opened a few years since by a committee of medical and educational missionaries. This school is international and interdenominational, and has for its object the training of medical helpers for the mission hospitals and dispensaries, especially in connection with the "zenana work," or work for women. The school is affiliated with the Government Medical College in Lahore, up to the hospital assistant degree. Were five or six medical missionary women from Great Britain or America to join the staff of the school, complete affiliation would be made possible; and could the institution receive an endowment sufficient to place it beyond all financial embarrassment, its usefulness would be multiplied many times. There are many physicians in our fair land who do not need to employ their time and talents in self-support. To such, the opportunities I have mentioned for the employment of medical science in the uplifting of humanity, must strongly appeal, for physicians must ever be found in the vanguard of civilization.

The Antitoxin Treatment of Diphtheria with a Plea for Rational Dosage in Treatment and in Immunizing.

BY B. FRANKLIN ROYER, M. D.

[Read January 11.]

In a discussion of the value of antitoxin as a curative agent, it is necessary to have a clear knowledge of the prevalence of diphtheria and of its mortality for a period of years preceding and following the introduction of serum treatment. In order to demonstrate to you the death rate of diphtheria and the attack rate, I shall rely largely upon reported cases and reported death rates, and the ratio between reported deaths and estimated population in large cities in this country. I do this for several reasons; in large cities statistics are compiled more carefully and more reliably than in smaller municipalities; it is much easier to make a collection of a large number of cases yearly and compare them with other years or, to compare groups of years with groups of years under different conditions; in large municipalities, particularly in medical centers, serum treatment has been universally adopted, and has been used with greater uniformity by the medical profession. For this study I have chosen the statistics from New York City, Brooklyn, Philadelphia and Chicago, and a table from the 12th census, and for the further study of the value of antitoxin I have taken the same statistics from these centers before and after antitoxin had come into general use, and to them I have added hospital statistics from Boston, London and Philadelphia, taking diphtheria classified by location of the disease, under operative procedure, by age periods, by year periods and by comparing groups of year periods with certain other groups of year periods. Certain of these statistics would seem to court criticism, others are so graphic in the lesson they teach us that none, I am sure, will question their truthfulness. The death rate in hospitals, I feel, is entirely reliable. The death rate when computed in percentage by comparing with attack rate in city statistics, is perhaps, not quite so reliable, because not all cases have been reported in time gone by, and perhaps a few escape the official report to the Health Bureau even in this city.

Let us turn to the statistics of New York City, studying them for a period of years, from 1888 to 1902, the latter year being the latest statistics I have been able to obtain.

OLD CITY (MANHATTAN AND THE BRONX).

Diphtheria, Croup and Membranous Croup.

Year.	Cases.	Deaths.	Death Rate per 100,000.	Case Fatality.	
1887	5,923	3,056	207.0	54.94	
1888	6,491	2,553	167.7	39.3	Total Cases 50,753
1889	6,489	2,291	146.2	35.3	" Deaths 19,186
1890	4,604	1,783	110.6	38.7	Case Fatality (7 years)
1891	5,364	1,970	118.7	36.7	37.8%
1892	5,184	2,105	123.3	40.6	Average No. Cases 6,344
1893	7,057	2,558	145.5	36.2	" " Deaths 2,398
1894	9,641	2,870	158.6	29.7	
1895	10,505	1,976	105.2	18.8	Total Cases 75,123
1896	11,399	1,763	91.2	15.4	Deaths 10,982
1897	10,896	1,590	81.0	14.6	Case Fatality 14.61%
1898	7,593	923	46.7	12.2	Average No .Cases 9,390
1899	8,210	1,085	53.9	13.2	" " Deaths 1,372
1900	8,364	1,276	62.1	15.3	Total No. lives saved
1901	7,726	1,227	58.5	15.9	Total number of
1902	10,430	1,142	53.4	10.9	lives saved 8,204

It will be seen in studying this table that the average yearly death rate, from 1887 to 1894, inclusive, was 2,398, the average attack rate reported to the Health Commissioner was 6,431, the percentage of deaths by attack rate was 37.8.

In Brooklyn the following table shows clearly the mortality statistics in diphtheria during the same period.

BROOKLYN.

Diphtheria, Croup and Membranous Croup.

Year.	Cases.	Deaths.	Death Rate per 100,000	Case Fatality.	
1888	2,297	1,385	164.2	55.9	
1889	2,798	1,467	180.9	52.4	Total Cases 16,443
1890	2,185	1,283	152.6	58.7	" Deaths 8,990
1891	1,850	1,180	135.8	63.8	Case fatality 54.57%
1892	1,829	1,137	126.6	62.2	Average Attack rate 2,349
1893	1,672	978	105.3	58.5	Death " 1,284
1894	3,812	1,660	173.0	43.5	
1895	4,687	1,454	146.6	31.0	
1896	5,231	1,310	127.8	25.0	Total No. Cases 32,214
1897	4,147	998	94.1	24.1	" ' Deaths 7,608
1898	3,221	745	68.9	23.1	Case fatality 23.61%
1899	2,894	744	65.7	25.7	Average No. Cases 4,028
1900	3,856	863	73.7	22.4	" " Deaths 951
1901	3,942	732	60.5	18.6	Total number of
1902	4,236	762	61.0	18.0	lives saved 2,664

Here the average attack rate from 1888 to 1894 was 2,439, the average death rate was 1,284, the percentage mortality, compared with attack rate, was 54.57 per cent.

In Chicago the treatment by the Department of Health was begun in October, 1895, and the two periods, therefore, include 1888 to 1895, as "before" and 1896 to 1903 as "during."

Following is a simple graphic showing of the two periods:

TOTAL DIPHTHERIA DEATHS BEFORE AND DURING ANTITOXIN TREATMENT.

Reduction in actual number of deaths, 5,400—or 47 per cent.

AVERAGE ANNUAL POPULATION.

DEATHS PER 10,000 OF POPULATION.

Increase of population, 52 per cent.

Decrease of diphtheria deaths, 63.4 per cent.

Chicago's statistics show from 1888 to 1895, inclusive, 11,488 cases, and a yearly average death rate of 1,436, while from 1895 to 1903 a total of 6,088 deaths, or a yearly death rate of 781. Taking the total number of deaths for each eight-year period in Chicago, we find a saving of 5,400 lives, or an actual reduction in number of deaths of 47 per cent., and when we in turn make an allowance for the increased population, the reduction of lives is actually 52 per cent.

In Philadelphia where we were a little slow to take up the use of antitoxin and where we know that antitoxin was first used only in the more severe types of cases, we cannot be said to have used this agent with any degree of uniformity before the beginning of 1897. For this reason I have not used the years 1895 and 96, believing them to be too little influenced by antitoxin to count as antitoxin years, and yet influenced too much to place with a group of years in pre-antitoxin days. The following table shows a total of 19,826 cases reported to the Board of Health during the period from 1888 to 1894 inclusive, with a total number of deaths of 8,825.

Year.	Cases Reported to the Board of Health.	Death from Diphtheria Croup.	Per cent. Mortality.	Estimated Population.	Death Rate per 100,000.	
1887	Not recorded.	858	....	993,801	36	Summary, 8 years, 1887 to 1904, inc.
1888	1170	323	53.24	1,016,753	31	Total cases 7 years 19,826
1889	1455	727	50.00	1,040,245	39	Total deaths 8 years 8,825
1890	1820	943	51.81	1,046,964	90	Av. yearly population 1,064,277
1891	3251	1362	41.89	1,069,264	127	Average yearly deaths 1,103
1892	5051	1757	34.78	1,092,168	160	Case fatality 7 years 40.18%
1893	3471	1159	33.39	1,115,562	103	Deaths per 100,000 103
1894	3608	1396	38.68	1,139,457	122	Cases for 1887 not recorded.
1895	3853	1349	35.00	1,163,864	116	
1896	3595	1155	32.13	1,168,793	91	
1897	5779	1474	25.50	1,214,256	121	Summary, 1897 to 1903 inclusive.
1898	4676	1154	24.67	1,240,266	93	Total cases 32,455
1899	4391	994	22.63	1,266,832	78	Total deaths 6,972
1900	5088	1042	20.47	1,293,697	80	Av. yearly population 1,309,118
1901	3578	643	17.97	1,321,408	48	Av. number of deaths 871
1902	2444	515	25.06	1,349,712	38	Case fatality 21.48%
1903	3043	608	19.98	1,378,624	44	Death rate per 100,000 54
1904	3456	542	15.68	1,408,154	38	

The average yearly population during this period was 1,074,345, the average mortality per 100,000 was 103, the average yearly death rate was 1,103, the total mortality computed from reported cases was 40.18 per cent. While during a period from 1897 to 1904, inclusive, the average yearly population was 1,309,118; the average number of deaths 871; the total number of reported cases 32,455; the total number of deaths 6,972. The mortality percentage 21.48; the average number of deaths yearly 871; the death rate per 100,000 was 54. It will be seen then, by comparing the latter group of eight years with the earlier group of eight years, that we have a total saving of 1,853 lives, or a total reduction in the number of deaths of 21.97 per cent. The increase in population during the same period has been 23 per cent., and should we allow for this increase in population, the decrease in deaths would be 35.92 per cent.

In New York City, during the eight years from 1895 to 1902, inclusive, a total of 10,982 deaths are reported with an average of 1,372 each year. The total number of lives saved during this eight-year period is 8,204, the actual reduction in deaths without allowance for increase in population, is 42.75 per cent.

In the City of Brooklyn, where antitoxin was not taken up quite so early or so earnestly, we have during the eight years ending in 1902, a total of 7,618 deaths, or an annual death rate of 951, as compared with 1,240 during the seven years preceding the introduction of serum. During the same interval 32,214 cases were reported to the Board of Health, with a death rate of 23.61 per cent., as compared to the preceding seven years with a mortality of 54.67 per cent.

To summarize from this data, we find that in Chicago where hospital accommodation is small, and where they very early aided serum therapy by appointment of antitoxin administrators and Board of Health intubators, the statistics show a very great deal of saving of life. In Chicago, as an earlier table has shown you, 5,400 lives have been saved; in Brooklyn 2,664; in New York City 8,204, and in Philadelphia 1,853. This makes a grand total of 18,121 lives saved in four American cities.

The question will at once be raised: Has antitoxin done all this saving of lives, or has any part been accomplished by better quarantine methods? To this argument I would reply, that quarantine had been enforced before the days of antitoxin. Laboratory methods too had been used in studying this disease, and yet, as some of the earlier quoted statistics will show, no material reduction in the number of deaths per hundred thousand of population. Then, as I have shown in the cases of Chicago and Philadelphia, we should have been entitled to a much larger number of deaths from diphtheria had we considered the increase in population during the antitoxin era. In Chicago, for instance, as already stated, the actual reduction in the number of deaths is 47 per cent., allowing for the increase in population it would be 52 per cent. In Philadelphia the actual reduction in deaths is 23 per cent., allowing for the increase in population it would be 35.92 per cent. In New York and Brooklyn I have not worked out this percentage, because I have not had the estimated population in year periods, but by making an approximate comparison it will be seen that the reduction there would be about midway between Philadelphia and that of Chicago.

The following table from the 12th Census, shows the number of deaths per 100,000 population in the largest cities in the United States:

Average annual rate	.....	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
Average for cities in New England	77	94	56	88	90	121	98	99	73	31	42	66
Boston, Mass.,	97	103	62	103	114	179	130	112	87	35	55	96
Fall River, Mass.,	44	69	30	74	35	49	70	72	30	18	21	25
New Haven, Conn.,	67	122	66	93	115	71	32	99	85	33	22	17
Providence, R. I.,	52	95	47	52	51	35	68	95	56	25	26	39
Worcester, Mass.,	54	40	49	76	52	74	68	65	54	32	37	46
Average for cities in Middle States	101	114	124	129	129	139	106	100	95	63	62	66
Jersey City, N. J.,	123	209	177	153	126	152	102	159	119	79	51	58
New York, N. Y.,	102	118	126	131	154	108	112	97	85	48	55	62
Newark, N. J.,	99	173	105	113	138	84	121	151	79	51	53	58
Paterson, N. J.,	126	87	200	171	112	171	99	134	184	69	84	96
Philadelphia, Pa.,	107	90	127	161	104	123	116	97	113	93	79	81
Rochester, N. Y.,	64	75	89	157	104	73	42	52	46	28	33	29
Scranton, Pa.,	70	182	71	53	13	21	54	72	72	54	98	87
Syracuse, N. Y.,	51	57	35	82	125	70	22	41	58	44	21	46
Average for cities in Lake States	79	119	118	123	104	93	98	76	49	38	51	46
Buffalo, N. Y.,	53	43	63	65	62	74	81	79	62	26	24	19
Chicago, Ill.,	86	115	118	129	117	107	119	77	52	44	56	50
Cleveland, Ohio,	68	104	109	120	92	60	62	73	38	41	32	48
Milwaukee, Wis.,	91	196	189	183	93	101	74	79	41	23	40	44
Toledo, Ohio,	83	263	128	79	110	37	42	55	22	30	128	79
Average for cities in Southern States	54	66	80	69	52	57	46	41	52	47	43	44
Baltimore, Md.,	68	73	89	95	46	50	66	59	85	63	56	71
Memphis, Tenn.,	17	50	49	17	10	19	25	5	7	5	10	5
New Orleans, La.,	31	56	44	46	50	61	28	20	17	5	7	13
Washington, D. C.,	42	68	107	60	77	78	26	41	44	76	70	41
Average for cities in West and Central United States	61	95	87	78	69	61	87	58	36	32	33	47
Cincinnati, Ohio,	67	165	107	105	68	74	51	55	45	23	29	26
Indianapolis, Ind.,	69	.....	157	156	110	59	100	39	23	28	40	33
Kansas City, Mo.,	39	26	45	22	35	45	64	61	33	30	29	42
Minneapolis, Minn.,	45	114	63	41	28	30	62	56	15	15	23	56
Omaha, Neb.,	57	129	115	86	49	53	34	41	35	15	19	20
St. Louis, Mo.,	68	54	74	60	76	76	136	72	45	47	43	75
St. Paul, Minn.,	56	90	74	108	64	42	73	48	30	42	26	35
San Francisco, Cal.,	51	61	151	104	73	24	15	14	33	46	32	23

The preceding table from the 12th census shows that this reduction was not local, but that in many parts of the United States a marked reduction took place after antitoxin was introduced. In five of New England's largest cities the average number of deaths per 100,000 population has been 77 for a period from 1890 to 1900 inclusive. Since 1896 the rate has been persistently below the average. In the eight largest cities in the middle states the average has been 101 per 100,000. Since 1897 it has remained below 66 per 100,000. In five large cities from the lake states the average has been 79, since 1896, 51 or below. The average for four Southern cities has been 54 per 100,000, since 1895 the average has been less than 50. For the seven large middle Western cities and San Francisco, the average 61 per 100,000, since 1897, has remained below 47 per 100,000.

In every instance in individual cities or in groups of cities the drop has been too sudden to attribute to any factor other than antitoxin as a curative and immunizing agent.

I am perfectly willing to admit that some reduction in death rate has been accomplished by better quarantine methods. I am willing to even grant that quarantine methods may have saved the difference between the actual reduction in number, and that which would have occurred had the older methods of treatment and quarantine been continued. I doubt whether the most enthusiastic health officer would claim much more. In hospitals, however, we are dealing with another problem. Here we know what we can do. Here we are dealing with similar conditions before antitoxin days and during the antitoxin era.

Let us for a moment study the statistics of the Metropolitan Asylums Board Hospitals in London. If the combined statistics of all hospitals in London under the supervision of the Metropolitan Asylums Board be summed up in tabular form, they express most graphically what antitoxin has done in that great city in a period from 1888, the time of the earliest admission of diphtheria patients to the M. A. B. Hospitals, to 1903 inclusive.

Year.	Admissions Diphtheria.	Deaths Diphtheria.	Mortality per cent. of Patients Treated in Hospital.		
1888	99	46	59.35		
1889	722	275	40.74		
1890	942	316	33.55	Total admissions,	11,598
1891	1,312	397	30.63	" Deaths,	3,517
1892	2,009	583	29.35	Mortality,	30.39%
1893	2,848	865	30.42		
1894	3,666	1,035	29.29		

Year.	Admissions Diphtheria	Deaths Diphtheria.	Mortality per cent. of Patients Treated in Hospital.		
1895	3,635	820	22.85		
1896	4,508	948	21.20		
1897	5,673	987	17.69		
1898	6,566	991	15.37	Total admissions,	56,145
1899	8,676	1,182	13.95	" Deaths,	8,008
1900	7,873	988	12.27	Mortality,	14.20%
1901	7,622	849	11.15		
1902	6,520	739	11.04		
1903	5,072	504	9.69		
Total	67,743	11,525			

During this time 67,743 cases passed through these hospitals with a total number of 11,525 deaths, in 1888 the death rate was 59.35 per cent., in 1903, 9.67 per cent. Grouping these years by periods preceding the introduction of antitoxin, and following it, we find in the interval, 1888 to 1894, inclusive, a total of 11,098 cases with 3,517 deaths, a mortality percentage of 30.32 per cent. Taking the period from 1895 to 1903, inclusive, 56,145 cases were treated in these hospitals with a total of 8,008 deaths, a mortality percentage of 14.26. Just a little less than half the mortality in the preantitoxin era. Taking the average death rates in these hospitals in quinquennial periods we have the following:

AVERAGE DEATH RATES FOR DIPHTHERIA IN METROPOLITAN ASYLUMS BOARDS HOSPITALS IN QUINQUENNIAL PERIODS.

1887–91	1892–6	1897–1901	1902–3
33.6	25.5	13.7	10.4

The following table includes only those treated with antitoxin:

M. A. B. REPORT, 1903.

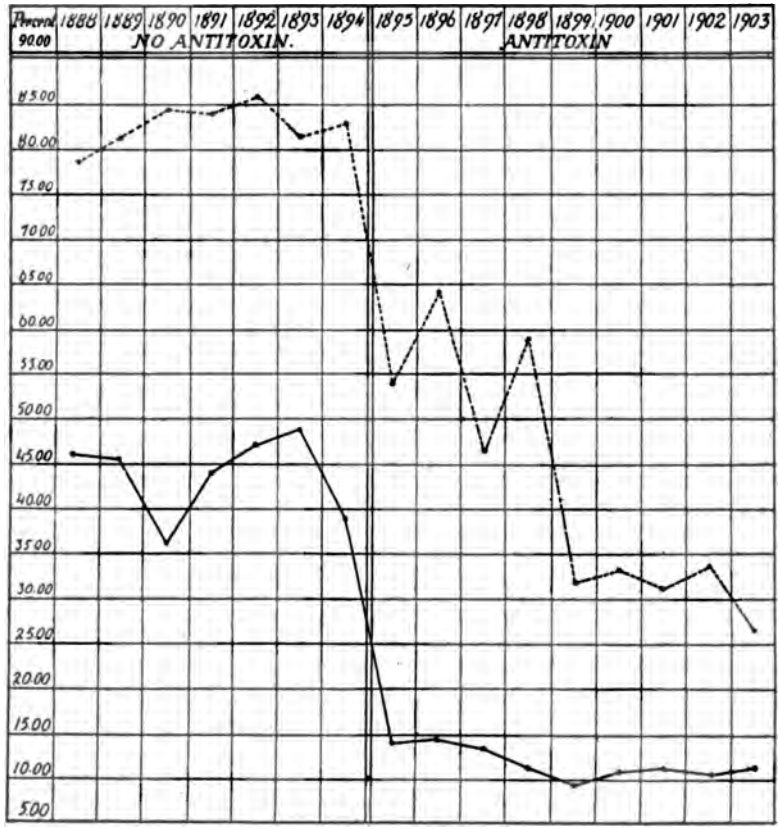
All forms of Diphtheria, 1890 to 1894, and this Table includes all cases treated with Antitoxin, 1895 to 1903.

	Year.	Cases.	Deaths.	Mortality. per cent.
Before use of antitoxin.....	1890–3	7,111	2,161	30.29
Antitoxin in occasional use.....	1894	3,042	902	29.65
Antitoxin used in every case in this table.....	1895	2,182	615	28.1
	1896	2,764	717	25.9
	1897	4,381	896	20.4
	1898	5,186	906	17.5
	1899	7,038	1,082	15.38
	1900	7,271	936	12.88
	1901	6,499	817	12.57
	1902	6,015	714	11.8
	1903	4,839	493	10.18

Coming home and taking the statistics of the Boston City Hospital and of the South Department, we have the following table which expresses well what antitoxin has done there. These figures and this graphic chart I am permitted to publish through courtesy of Dr. John McCollum:

Per cent. of Mortality of Diphtheria at the Boston City Hospital proper, and at the South Department from 1888 *to* 1903, *inclusive. Per cent. of Mortality for the same Period.* 1888 *to* 1894 *no Antitoxin;* 1895 *to* 1903 *Antitoxin*

DIPHTHERIA INTUBATION



Year.	Number of Cases of Diphtheria.	Died.	Per cent. of Mortality.	Per cent. of Recovered.	Number of Incubations.	Died.	Per cent. of Mortality.	Per cent. of Recovered.
1888	382	176	46.07	53.92	100	78	78.00	22.00
1889	529	239	45.17	54.82	128	104	81.25	18.75
1890	415	151	36.38	63.61	93	79	84.94	15.05
1891	237	105	44.30	55.69	50	42	84.00	16.00
1892	387	185	47.80	52.19	65	56	86.15	13.84
1893	419	203	48.44	51.55	109	90	82.56	17.45
1894	698	266	38.10	61.89	89	74	83.14	16.85
Total	3,067	1,325	43.20	56.79	634	523	82.49	17.50
1895	1,455	207	14.22	85.77	118	64	54.23	45.76
1896	1,889	276	14.61	85.38	224	145	64.73	35.26
1897	1,387	181	13.04	86.95	146	67	45.88	54.11
1898	817	97	11.87	88.12	71	42	59.15	40.84
1899	1,621	162	9.99	90.00	192	63	32.81	67.18
1900	2,547	293	11.50	88.49	259	87	33.59	66.40
1901	1,576	185	11.73	88.26	184	58	31.52	68.47
1902	1,008	111	10.20	89.79	145	49	33.79	66.20
1903	1,179	138	11.70	88.29	139	37	26.61	73.38
Total	13,479	1,650	12.24	87.75	1,478	612	41.40	58.59

Here we find a total in the preantitoxin days of 3,067 cases, 1,325 deaths, a death rate of 43.2 per cent. in all forms of diphtheria and laryngeal cases requiring intubation, a total of 639 cases, 523 deaths, a mortality of 82.49 per cent. Compare this with the period after antitoxin was introduced in Boston. In the antitoxin era we find the total of 4,779 cases, 1,650 deaths, a death rate of 12.24 per cent., and during the same interval with 1,478 intubated cases, 612 deaths, a mortality rate of 41.4 per cent. It will be seen by these tables that in all forms of diphtheria a reduction in mortality has been made from 43.2 to 12.24 per cent., and in laryngeal diphtheria requiring intubation the mortality was cut in half.

In our own city, and in our own hospital, we are not able to quote such remarkable results. I believe there are very good reasons why we have not accomplished here what has been done in other places. In the first place our Municipal Hospital has, unfortunately, borne the name of "Pest House" ever since diphtheria was first admitted for treatment. During a part of the antitoxin era we were so unfortunate as to be compelled to treat on the same grounds many hundreds of cases of smallpox. I am sure my distinguished predecessor, Dr. Welch, will bear me out in the statement that many mothers will not

permit their children to come to the hospital because of its proximity, or as they feel, its actual contact with the smallpox hospital. Largely because of this unfortunate situation in Philadelphia, we have a much higher percentage of severe cases than other similar institutions, and our mortality statistics are made up from bad cases rather than a mixture of all types of this disease. It is for this reason, I believe, that we get our cases late in the disease. Many mothers, and I fear in some instances physicians too, have a certain fear about sending a child to the Municipal Hospital, unless they are positively convinced that the case is one of severe diphtheria, and that it must have hospital care. Then, too, there is another reason: Philadelphia physicians assumed an attitude of extreme conservatism toward antitoxin. It was taken up late and in no very enthusiastic way, and practitioners tended to delay giving it until they saw the case would be a serious one.

The following table from our own hospital statistics show that even with Philadelphia's conservatism and its unfortunate situation, as far as her hospital is concerned, a considerable reduction in death rate has been accomplished:

Year.	Diphtheria Patients Treated.	Died.	Per cent. Deaths.	
1892	183	48	28.22	Measles and mixed cases included.
1893	217	62	28.57	
1894	465	154	33.12	
Total	865	264	30.52	
1895	706	190	26.91	
1896	869	193	22.02	
Total	1,575	283	24.32	
1897	1,295	300	23.16	
1898	1,229	297	24.16	
1899	1,273	275	20.02	
1900	1,299	264	20.31	Measles excluded.
1901	889	174	19.57	Measles and mixed cases included.
1902	601	137	22.79	
1903	581	97	17.73	Measles, mixed cases and moribund cases dying in 24 hours excluded.
1904	712	77	10.81	
Total	7,779	1,621	20.31	

These reductions in city death rates and in hospital practice is but a small part of the reduction which can be accomplished if the family practitioner will but take up the use of antitoxin in sufficient

dose to cure, without waiting for a culture return to confirm him in his suspicions.

The above quoted statistics require no explanation other than to say, no material change has occurred in treating diphtheria since the introduction of antitoxin. The tendency is more toward withholding drug treatment and toward giving larger doses of antitoxin when indicated. It tends toward early diagnosis and early administration of serum.

I am sure there are those who believe the general adoption of intubation for laryngeal stenosis has, in this country, been largely responsible for the decrease of mortality. To combat this argument I submit the following table from the M. A. B. Hospitals where tracheotomy is still practiced:

M. A. B. HOSPITALS' REPORT FOR 1903.

All forms of Laryngeal Cases. Cases treated with antitoxin.

	Year.	Cases.	Deahts.	Mortality Per cent.
Antitoxin in occasional use....	1894	466	289	62.0
Antitoxin years.....	1895	461	195	42.2
	1896	488	141	28.8
	1897	473	142	30.0
	1898	624	199	31.9
Cases receiving antitoxin.....	1899	669	190	28.4
	1900	777	182	28.2
	1901	753	159	21.1
	1902	618	125	20.2
	1903	551	99	17.96

M. A. B. HOSPITAL REPORT FOR 1903.

Tracheotomy Cases.

Cases treated before antitoxin days and treated with antitoxin.

	Year.	Cases.	Deaths.	Mortality Per cent.
Before use of antitoxin.....	1890–3	364	241	62.2
Antitoxin in occasional use.....	1894	261	184	70.49
	1895	225	113	50.2
	1896	197	8	40.6
	1897	258	103	39.9
	1898	305	113	37.0
	1899	377	147	39.1
	1900	377	127	33.65
	1901	367	111	30.2
	1902	257	82	31.9
	1903	176	56	31.82

Compare these statistics with a preceding table and a chart from the Boston City South Department and you will see antitoxin has done in London tracheotomy cases just what it has done in America for intubation cases, or compare them with our own hospital statistics, they would tend to prove that intubation has not done in this

Year.	Total Number of Cases.	Total Number of Deaths.	Percentage Mortality.	
1894	100	75	75.00	
1895	122	67	45.91	Antitoxin in occasional use.
1896	156	94	60.25	
Total	378	236	62..43	
1897	182	127	69.78	
1898	149	104	69.99	
1899	165	97	58.78	
1900	202	111	54.95	Antitoxin in general use.
1901	139	66	47.47	
1902	110	54	49.09	
1903	108	52	48.14	
1904	125	50	40.00	
Total	1,180	661	56.01	

country all that some claim of it.

All the preceding tables seem to show that antitoxin has reduced the mortality very greatly in all hospitals.

Let us now take up the question of dosage:

From a paper recently read by Dr. Louis Fisher of New York City, (some of you will remember that Dr. Fisher was the first man in the United States to publish a clinical report of the use of antitoxin), I find that the dose he teaches the house officers of the Willard Parker Hospital is very much like that dose in use at the present time in our Municipal Hospital. He feels as we feel, that the proper dose of antitoxin must be somewhat empirical, that it must not be less than will "limit the pseudomembrane, subdue the fever and check the progress of the disease."

In an abstract from this paper read before the New York Academy of Medicine, November 10, 1904, published in *Archives of Pediatrics* for December, 1904, I cull the following mortality statistics from the Willard Parker Hospital:

RESUMÉ OF CASES REPORTED FROM THE WILLARD PARKER HOSPITAL DURING JULY, AUGUST AND SEPTEMBER, 1903:

	Number.	Died.	Mortality Per cent.	Recovery.
Tonsillar and pharyngeal	292	34	11.64	88.36
Tube cases	69	42	60.87	39.13

RESUME OF CASES REPORTED FROM THE WILLARD PARKER HOSPITAL DURING JULY, AUGUST, SEPTEMBER AND OCTOBER, 1904:

	Number.	Died.	Mortality Per cent.	Recovery.
Tonsillar and pharyngeal	253	25	9.84	90.16
Tube cases	115	41	35.65	64.35

"The average dose of antitoxin administered during 1903 was for July, 1,500; for August, 1,700, and for September, 2,500 units; the average dose of antitoxin administered during 1904 was for July, 2,500; for August, 5,000, and for September, between 5,000 and 10,000 units. As a result, it has shown about 21 per cent. mortality where the dose was small, against a mortality of 14 per cent. where the larger doses were used."

For a mild case, from 500 to 5,000 units were used. If there was a large exudate on the tonsils and pharynx, from 5,000 to 10,000 should be given on the first day and repeated within twelve hours, if no improvement is shown. In cases of laryngeal diphtheria, with stenosis, the initial dose should be 10,000 units. He had never seen any case that suffered any ill-effects from large doses."

In the discussion which followed the reading of Dr. Fisher's paper Dr. Park, whom some have learned to look upon as one advocating small doses of antitoxin, had this to say of doses: In mild cases either early or late involving tonsils or pharnyx he uses 2,000 units; in severe early cases, 4,000 units; in ordinary laryngeal cases, 5,000; in malignant severe cases tonsillar, pharyngeal or nasal, 10,000 units, and repeats this dose at the end of 10 or 12 hours until the patient is distinctly better."

Dr. McCollum, of the South Department, Boston City Hospital, has long advocated large doses in severe cases.

The following doses are in use at the present time in my wards at the Municipal Hospital:

Purely tonsillar exudate (single) 2,500 units, purely tonsillar exudate (double) 5,000 units. Tonsillar exudate with involvement of pillars and uvula or pharynx 7,500 to 10,000 units Nasal and any other part involved 7,500 to 10,000 units. Laryngeal 7,500 to 10,000 units.

Repeat the dose in each case in from 12 to 24 hours, depending upon the severity of the disease and the signs of improvement as shown by general condition and disappearance of exudate. If the exudate is rapidly separating do not give a second dose. Where a great amount of exudate remains give a daily dose of from 5,000 to 7,500 units until the greater portion of it has disappeared. With patients admitted after the seventh day of disease give 2,500 units only. Do not repeat. When patients have remained in the ward six weeks give immunizing dose of 2,500 units.

We give very large doses in nasopharyngeal diphtheria because we know with pseudomembrane present in this locality, toxicity is greater than with it in any other. There is a good anatomic and histologic reason for this increased toxicity. The basement layer of the mucous membrane lining the nasopharynx covering the pharyngeal tonsil and back portion of the uvula is a complete network of lymph channels ready to open and carry away any absorbable material. In the faucial tonsils and low on the pharynx the lymph channels are less numerous and the fibrous tissue is more abundant, hence less absorption. Then, too, in the nasopharynx you quickly get plugging with damming back into this cavity toxins that from the tonsils might be expectorated. Exudate, serum and secretion are firmly held in the nasopharynx. We give large doses in laryngeal diphtheria because we not only want to neutralize the toxins, but because we must limit the extension of pseudomembrane. We do not give large doses after the seventh day of the disease, because the damage done is irreparable.

Having proven the value of antitoxin, and having shown the reduction in deaths from diphtheria in large cities and in large hospitals, and having shown the tendency to give larger doses, with an argument in favor of doses determined from amount of exudate and location of exudate, we now take up the most vital part, viz.: when to give antitoxin. Before deciding when to give it let us take up the statistics of the Brook Hospital, London, the collected statistics from Chicago and our own statistics for 1904.

STATISTICS OF THE BROOK HOSPITAL, LONDON.

JOHN MACCOMBIE, MEDICAL SUPERINTENDENT.

Antitoxin Treatment.—Of 716 completed cases, 610 were treated with antitoxin. The following table shows the result of the antitoxin treatment with especial reference to the day of disease on which the treatment began:

Ages.	Day of Disease on Which Treatment Began.										Total.		Percentage Mortality.
	1st.		2d.		3d.		4th.		5th.				
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	
Under 1	0	0	2	0	3	0	2	2	2	1	9	3	33.3
1 to 2	4	0	5	0	10	4	9	2	12	4	40	10	25.0
2 to 3	7	0	11	0	16	5	14	4	21	5	69	14	20.2
3 to 4	2	0	20	2	19	6	7	0	22	2	70	10	14.2
4 to 5	0	0	16	2	21	3	14	2	27	6	78	13	16.6
5 to 10	5	0	65	2	66	12	45	6	64	9	245	29	11.8
10 to 15	2	0	12	0	23	0	18	2	13	2	68	4	5.8
15 to 20	0	0	7	0	7	0	1	0	2	0	17	0	0.0
20 and upwards	0	0	3	0	5	0	2	0	4	0	14	0	0.0
Total	20	0	141	6	170	30	112	18	167	29	610	83	13.6
Percentage Mortality	0.0		4.2		17.6		16.07		17.3		13.6		

For the purpose of comparison I give the results of the antitoxin treatment here for the seven years, 1897 to 1903 inclusive (the figures in brackets are to total number of cases):

	1897	1898	1899	1900	1901	1902	1903
Of cases [187] treated on 1st day of disease the mortality per cent. was	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Of cases [1186] treated on 2d day, mortality per cent. was	5.4	5.0	3.8	3.6	4.1	4.6	4.2
Of cases [1233] treated on 3d day, mortality per cent. was	11.5	14.3	12.2	6.7	11.9	10.5	17.6
Of cases [963] treated on 4th day, mortality per cent. was	19.0	18.1	20.0	14.9	12.4	19.8	16.07
Of cases [1260] treated on 5th day, and after	21.0	22.5	20.4	21.2	16.6	19.4	17.3

During the past seven years the total number of cases of diphtheria treated with antitoxin in this hospital has been 4,812. Not a single death has occurred among the cases that came under treatment on the first day of the disease, and among those that came under treatment on the second day, the mortality has not exceeded 5.4 per cent., while among those that came under treatment on the third day and later the mortality is much higher. These facts show how emi-

nently curable a disease diphtheria is if treated with antitoxin early enough, and how large a number of lives would be saved if all the cases would be put under antitoxin treatment on the first or second day of the disease.

In Chicago, between October 5, 1895—date of first case treated—and December 31, 1903, the antitoxin administrators of the department treated 7,435 cases of bacterially-verified diphtheria, of which number 479 died—a mortality rate of 6.44 per cent. The average mortality without antitoxin still remains about 35 per cent.

That the value of antitoxin depends upon its early administration is shown by the following:

Of the total 7,435 cases, 586 were treated on the first day of the disease, with 2 deaths—mortality rate, 0.34 per cent. Of 1,913 treated on the second day, 28 died—mortality rate 1.46 per cent. Of 2,624 treated on the third day, 85 died—mortality rate 3.24 per cent. Of 1,374 treated on the fourth day, 148 died—mortality rate 10.8 per cent. Of 936 first treated later than the fourth day, 216 died—mortality rate 23.1 per cent.

There were included in the total 7,435 cases, 608 intubated laryngeal cases, of whom 508 recovered; mortality rate of intubated cases 16.54 per cent. The former mortality of this class of cases—intubated are tracheotomized—was about 85 per cent.

MUNICIPAL HOSPITAL REPORT FOR 1904.

Day of Disease and Results.

Day of Disease.	Admitted.	Died.	Per Cent.	
1st day	43	0	00	
2d "	220	9	4.09	Measles, mixed cases and moribund cases dying in 24 hours omitted.
3d "	153	21	13.72	
4th "	114	20	17.54	
5th "	61	9	14.75	
6th " and over	121	18	14.87	
Total	712	77	10.81	

In a recent letter from Dr. John H. McCollum, South Department Boston City Hospital, he makes the following statement:

"Experience has taught me that the golden time for administering antitoxin is during the first twenty-four hours of an attack of diphtheria. I have yet to see a patient die from diphtheria who had antitoxin in sufficiently large doses within twenty-four hours of the commencement of the attack.

Since the South Department was opened we have had 180 cases of diphtheria among the doctors and nurses, and not a single death, because each patient received a large dose of antitoxin at the outset. I go so far as to say that when a throat has a suspicious appearance it is better to give antitoxin at once and not wait for the result of the culture. Nobody believes more thoroughly than I do in bacteriologic examinations of the throat. Nobody has worked any harder on that line than I have. Nobody has any wider experience than I have, yet, I cannot help feeling that in a given case of diphtheria much valuable time is lost by waiting for the result of the culture.

I think it is true that patients are coming to the South Department earlier now than they did a few years ago. It frequently happens that one member of the family will have an attack of diphtheria and will be treated at home for four or five days, sometimes with antitoxin and sometimes without, and then sent to the hospital as a last resort. The patient is seriously ill and frequently succumbs to the disease. As soon as the other members of the family show any symptoms of sore throat they are at once sent to the hospital, have antitoxin and recover."

The time to give it, gentlemen, is when you have clinical evidence of diphtheria. Do not await a culture report; do not wait to see if you will have severe diphtheria. Give it at onee.

We very frequently have patients sent to us three, four or five days in the disease treated by a physician for two or three days and no antitoxi n given. I believe that you would find it exceedingly difficult to defend yourself in a court of law were proceedings brought against you for neglecting to give such a life-saving agent until the time had passed when it would positively cure your patient.

These statistics in day of the disease require no explanation and no comment. If antitoxin is given early and in an appropriate dose the loss of life will be practically nil. If delayed several days the mortality will be very great.

As an immunizing agent, antitoxin is too little used by the profession. It is very common for us to receive at the hospital a patient very ill with diphtheria, and in from two to three days receive a second or third case from the same home. In fact, in a recent experience a child died at home the fifth day of disease without antitoxin, and in three days we received the mother and six children. Not one of these cases should have contracted the disease. All of that suffering and

distress would have been saved had the simple, harmless precaution of immunizing those exposed, been practiced.

We very often have mothers accompany sick babies to our acute wards and live there. We many times have had sick mothers bring with them nursing babes not suffering with the disease. No precaution is taken and no treatment given beyond immunizing them well. We do not expect them to get the disease. We practically assure them that they cannot get diphtheria if immunized.

Some of you may feel that you will impose upon your clientele too great an expense by this liberal use of serum. I grant you this may be true in certain classes. The Bureau of Health stands ready to supply your patients with antitoxin when they cannot afford to buy it in the market, and should you not care to give it, the Bureau of Health stands ready to send a medical inspector to the home to give it in curative or in immunizing doses as you may direct.

There is no excuse at the present time for neglecting to immunize those exposed to diphtheria. I question if you could defend yourself comfortably in a legal action if you were called upon to prove that you had used "reasonable care" when you had neglected to immunize a family, if those exposed subsequently developed the disease, and the family then proceeded against you.

There seems to be a rational method of dosage even in immunizing. I would recommend for the household 500 units for those not directly exposed, 1,000 units for those directly exposed, and 1,500 units if any sign of illness were present.

I have not yet seen a case of diphtheria develop where a patient had been immunized at the time of exposure or soon after.

In conclusion, I would remind you that in New York City (Manhattan and the Bronx) Brooklyn, Chicago and Philadelphia, 16,408 lives have been saved through the introduction of antitoxin as a curative and prophylactic agent in the treatment of diphtheria.

The death rate in diphtheria hospitals has been greatly reduced and in many instances cut in half by the introduction of serum therapy. We would plead for a dose of antitoxin in proportion to the amount of exudate and location of the exudate. We would urge a large dose of antitoxin in nasal, nasopharyngeal and laryngeal diphtheria. We would plead for the general use of antitoxin earlier in the disease. We would plead for more general use of antitoxin as a prophylactic measure in a dose proportionate to the amount of exposure and time of exposure.

DISCUSSION.

DR. M. H. FUSSELL: The paper confirms what I am sure is the opinion of the best men of the country in regard to the value of antitoxin. I rise to emphasize the point which Dr. Royer made in regard to the high mortality which still obtains in Philadelphia. I am glad to hear him say that he believes the reason the mortality is so high in the Municipal Hospital is because they receive very bad cases which have not been previously treated with antitoxin. I have always felt that that certainly must be the case. Another reason which he gives for this high mortality, which is equally true, is the conservatism of the practicing physician in regard to the use of antitoxin. Unfortunately, that still exists. It has not been long since a young practicing physician said to me, "In 10 years we will all throw our antitoxin syringes in the ash heap and be ashamed that we ever used antitoxin." I cannot understand such an attitude in any man who thinks at all. Any one who has seen diphtheria now and 20 years ago knows that we could not control it then. Now we do cure every case of diphtheria in which we give antitoxin in sufficient doses in the early part of the disease.

DR. A. A. ESHNER: I presume, Mr. President, in speaking of the administration of antitoxin, Dr. Royer has confined himself exclusively to its hypodermic use. I have recently seen references to the intravenous employment of antitoxin which I can conceive, in malignant cases and perhaps in some of the late cases, might be serviceable when ordinary treatment might not suffice. I think I have also seen references to the employment of antitoxin by the mouth, by administration through the digestive tract, but less could be expected from this mode than from hypodermic or intravenous injection.

DR. ROYER: We have used antitoxin intravenously for about 16 months at the Municipal Hospital in severe malignant cases. In my report to the Bureau of Health a year ago, I mentioned using it in 14 cases. We have not especially studied the statistics from these cases. We have used it only in cases that seemed hopeless and we have been gratified to see a few get well. I think it is worth trying in severe malignant cases seen late. I did not mention it in my paper, because I did not suppose any of the gentlemen present would see a late case of diphtheria. I supposed they would see the case early and give antitoxin at once.

Specimens Illustrating the Need of Early Operation in Surgical Diseases of the Abdomen.

By JOHN B. ROBERTS, M. D.

[Read January 25.]

Specimen I. STRICTURE OF THE SIGMOID FLEXURE DUE TO ULCERATION OF THE MUCOUS MEMBRANE. The patient was first seen when in a state of great emaciation. This was due to a several weeks' illness, of sudden onset, accompanied by vomiting, abdominal pain and loss of strength. Study of the case and attempts to increase the

nutrition prior to operation consumed about two weeks' time. A diagnosis of obstruction of the gastrointestinal canal in the neighborhood of the pylorus and duodenum was made. The condition of the patient was so bad that a jejunostomy alone seemed possible. This was done for the purpose of feeding the patient prior to a more extensive examination of the abdomen and operative relief of the condition found.

Death occurred, after a few days, from exhaustion. It was then found that the obstruction was in the sigmoid flexure. This pathologic condition renders it difficult to understand the great emaciation of the patient.

Early operation would have given opportunity to explore the abdomen and to have found the stricture. Operative relief would almost certainly have been accomplished by excision of gut or intestinal anastomosis.

Specimen II. PERFORATED DUODENAL ULCER CLOSE TO THE PYLORUS. The patient's history and symptoms were rather indefinite at first and he was supposed to have chronic cholecystitis. A study of the case convinced me that there was ulceration above or below the pylorus. A time for operation was appointed, but before operation was done perforation occurred. Although I saw the patient about six hours after perforation, his collapse was so extreme that operation did not hold out prospect of relief. I, however, advised operation as a last resort, but the patient and his friends would not consent. There is little doubt that a gastrojejunostomy done a day or two prior to the time of perforation would have saved this patient's life.

Specimen III. A PERFORATED APPENDIX removed from a case that came under my care about forty hours after an attack of abdominal pain. The man had worked all day and was seized with severe pains in the night. The attending physician was called and found nothing serious in the symptoms until about thirty hours later, when symptoms of perforation of the intestinal tract occurred. When I saw the man his pulse was 160 and very feeble. His hands were cold, his face was covered with clammy sweat, and the abdomen was distended and painful. I felt that operation would almost certainly result in death upon the table, and therefore, abstained from even opening the abdomen.

The autopsy showed the lower abdomen full of pus with a gangrenous opening in the appendix big enough to admit a lead pencil.

Specimen IV. A LARGE GALL STONE, measuring an inch-and-a-half by three-quarters of an inch, taken from the gall bladder of a woman, who had suffered, during several years, from repeated attacks of pain in the region of the gall bladder. Operation, which was finally demanded by the severity of her suffering, showed the stomach, gall bladder, liver and omentum to be bound together by old and firm adhesions. The gall bladder was dragged backward until its fundus pointed toward the spinal column. It was entirely filled by this large stone. The patient had, in addition, a bent and adherent appendix from former attacks of appendicitis. This was removed. The gall bladder was opened and the calculus removed only with great difficulty. Drainage through the lumbar region was employed and a large drainage tube introduced through the abdominal incision. The patient did moderately well for about two days and then died from asthenia. There appeared to be no sepsis.

This case shows the importance of operative treatment in the early stage of all cases of gall stone disease. Operation at such times is very simple; but repeated attacks of inflammation in and around the gall bladder make the operative risk very great.

Specimen V. A GLOBULAR GALL STONE three-quarters of an inch in diameter removed from the junction of the hepatic, cystic and common gall ducts. It caused almost complete, if not complete, obstruction of the flow of bile into the duodenum. The patient had great pain, and persistent jaundice, which at the time of operation gave her a dark bronze color. Exploratory incision showed the omentum adherent to the gall bladder and the stone tightly impacted in the ducts, at the point above mentioned.

Choledochotomy was required for extraction of the stone and was followed by drainage with tubes placed in the gall bladder, the incised duct and the general peritoneal cavity. Death occurred at the end of two weeks from asthenia. This patient's life would probably have been saved by early operation. Operative removal when the stone was still in the gall bladder, at the time of the first symptoms of disease, would have been a very simple procedure, almost certainly followed by rapid convalescence.

These specimens are shown to call the attention of the members of the Society to the importance of operating early upon cases of cholelithiasis, inflammation of the appendix and obscure lesions of the stomach and intestines. The best results will undoubtedly be obtained in such cases by early exploratory incision, followed by operations for

relief, even if such surgical methods are employed before definite diagnosis can be made. The profession and the public should realize that this is the teaching of modern surgery.

DISCUSSION.

DR. L. J. HAMMOND: I have not yet, myself, learned just how to handle my patients to show them the importance of operation when the diagnosis is made, and like most men, perhaps, I have had some experiences that are very discouraging as a result of these delays. Frequently we see cases in which diagnosis is readily made and early operation advised, and find that the patients will go from surgeon to surgeon and from hospital to hospital in the hope of finding some one who will promise a cure without recourse to the knife. The results are, as Dr. Roberts has pointed out, rendered hopeless by the time they and their friends decide favorably upon it. I do not feel that the delay is always the fault of the surgeon or the physician. I have in mind a number of gallstone cases, one of 6 months' standing in which all the characteristic symptoms were present and the danger clearly placed before them of delaying operation, and still they postponed operation.

The Effects of Carcinoma Upon the Nervous System.

By T. H. WEISENBURG, M. D.

(From the Neuropathological Laboratory of the University of Pennsylvania.)

[Read January 25.]

The influence of carcinoma of parts other than the brain and spinal cord upon these structures has been well recognized. These may be divided into (1) the symptoms produced by metastasis, and (2) those symptoms which are supposedly toxic.

The most frequent metastases occur in the vertebræ, and are more often secondary to carcinoma of the breast than of the other organs. This, while not very common, is of sufficient frequency to merit attention. A well developed case of vertebral carcinomatosis gives such a typical clinical picture, that, as a rule, the diagnosis does not offer much difficulty. The new growth involves the vertebræ, and irritates the posterior roots, which have their course between these vertebræ, and, therefore, causes sharp shooting pains which are referred to different parts of the body. At times an herpetic eruption is the first manifestation. As the tumor grows, the spinal meninges, and finally the spinal cord itself, is involved, and we have a resulting pressure myelitis, which causes paralysis of the upper or lower limbs,

depending upon the site of the lesion, loss of bladder and rectal control, anesthesia and absent reflexes. The pain in these cases is intense. I know of no nervous affection which is so painful, and because of this, this symptom complex has been termed "paraplegia dolorosa."

It is sometimes impossible to diagnose this disease from other conditions. Spiller and I reported three cases in which a diagnosis of vertebral carcinomatosis, multiple neuritis and Pott's disease was impossible in life, the necropsy denoting the condition.

The carcinoma cells hardly ever invade the substance of the brain or spinal cord. When metastasis occurs in the brain the tumor generally grows from the cranial bones or the membranes, but very rarely may grow in the brain substance. It does not compress, but destroys the tissue. Of course, in these cases we would have the symptoms of brain tumor. Dr. Mills refers to a case in which he made a diagnosis of basal syphilis, but at the necropsy, which was performed by Dr. Spiller and myself, a carcinoma was found upon the optic chiasm and compressing the different cranial nerves. This case was exceedingly instructive, because it taught that, in instances in which carcinoma occurs, complicating cerebral symptoms, no matter how unusual, may be secondary to the malignant growth.

Oppenheim first called attention to the toxic influence of carcinoma upon the nervous system. Since then similar cases have been recorded. In these instances we may have mental apathy, dementia, hemiplegia, either with or without aphasia, monoplegia, and even convulsions of an irregular type have been recorded. These symptoms come on suddenly, persist only a short time, and may disappear or recur. Their resemblance to similar symptoms occurring in uremia is remarkable. Lately I have seen a number of such cases, and I am inclined to believe that they are more frequent than is commonly supposed. Very recently I recorded a case of dementia, and again a very interesting case in which bulbar symptoms occurred, accompanying a carcinoma of the breast. It would be well if more attention were paid to this subject.

There is a diversity of opinion regarding the cause of these symptoms. The majority of writers believe that they are of toxic origin, but no further explanation is offered. Saenger, who found an infiltration of carcinoma cells in the cerebral and basal pia, believes that this infiltration is the cause of the cerebral involvement. In the bulbar case previously referred to, I found alterations in the nerve cells of the different bulbar and pontine nuclei. While these changes

have been previously described in one or two instances, they were limited, in these cases, to certain nuclei. In my case they were more diffuse. In another case which I have had with Dr. J. W. McConnell, in which there was a vertebral carcinomatosis, but no psychic symptoms, I found distinct changes in the cortical cells. This is an important finding, for it shows that carcinoma may cause alteration in the nerve cells without demonstrable clinical symptoms.

My attention has been called to a statement attributed to Kocher, that mental symptoms never accompany carcinoma except in ulcerative conditions. While this may be so, I have, nevertheless, observed cerebral symptoms in which the post mortem examination revealed no sign of pus. This, however, is an interesting suggestion. It is hard to explain clearly how carcinoma influences the nutrition, but the fact remains that alteration in the blood elements results, and as a consequence, we may have changes in the nerve cells. These symptoms should, of course, be more prominent in an ulcerative condition.

DISCUSSION.

DR. R. N. WILLSON: About a year ago, when Dr. Weisenburg was working on the influence of uremia upon the brain cells, I was working upon the same subject from a clinical standpoint. He showed that uremic toxins altered and destroyed certain cells in the brain. At the same time we were able to show by autopsies and clinical studies in the Philadelphia General Hospital, that there was also another influence at work in uremia. We found that in cases of uremia that showed coma, convulsions, hemiplegia or aphasia, complete relief was often obtained by tapping the spinal canal and drawing off one, two or more ounces of cerebrospinal fluid. We also proved that certain cases seemed to be purely toxic cases. I am reporting 10 cases in which absolute relief of the uremic seizure was obtained after doing lumbar puncture. Dr. Weisenburg demonstrated that the toxins produced distinct lesions. He has now indicated that in carcinoma there is also a toxin at work. Clinical proof is not wanting that this is true in such conditions. In a case of uremic hemiplegia having a third attack we made lumbar puncture and failed to obtain any fluid. We then withdrew 23½ ounces of blood with no clinical result. Though pressure was relieved the patient was in coma, had general convulsions, and the hemiplegia persisted. We felt that there must be another influence at work than simple pressure, and that this must be a toxin. This we proved still further by the use of aconite. Acting upon Thomson's theory that the toxic principle in uremia is a substance similar in action to adrenalin, and that aconite is its therapeutic opposite, we began with 5 drop doses, increased to 10 and 15 drops every 2 hours, and continued for 4 days. Gradually the pulse became smaller and smaller, and now the patient is in better condition than she has been for many weeks, being perfectly well so far as subjective symptoms are concerned. The second aortic sound is

more normal and the hypertension of the vessels has almost disappeared. I would suggest that in the toxemia of carcinoma there may also be pressure in the brain causing the destruction of tissue which Dr. Weisenburg has just described, which, possibly, lumbar puncture might relieve.

DR. WEISENBURG: The subject of the influence of toxins upon the nervous system is a very important one. Recent investigations upon this subject have shown that the nervous system is among the first to be influenced in a toxic process. This is especially so in uremia. It is known that other malignant tumors, such as lymphosarcoma, have produced symptoms of cerebral involvement. Such cases have been recorded by Oppenheim and others. I do not know of any case on record in which a benign tumor has ever been accompanied by symptoms or involvement of the brain and spinal cord. I have brought this subject before this Society with the hope that more attention will be paid to the mental and other symptoms which are liable to accompany malignant tumors situated elsewhere than in the nervous system.

A New Saw Especially Adapted to Cranial Surgery.

By H. C. MASLAND, M. D.

[Read January 25.]

It is a matter of common knowledge that the present instruments for opening the skull in cranial surgery are crude and unsatisfactory from many points of view.

Some months ago, in making certain bone sections, the idea of utilizing the circular saw occurred to me. The development of those thoughts I present to you in the instrument under consideration.

It is composed of a handle heavy enough to prevent vibration, and of such shape as to permit a firm grasp with the hand. On the upper part is a shoulder to accommodate the thumb. On the lower aspect of the handle are grooves for the fingers, with a ring for the index finger. This ring protects the finger absolutely from the rapidly revolving saw, and also gives a rigid base to brace, when desired, the handle against the head. I originally provided a sharp pin on the lower edge of this ring to press into the bone to anchor the instrument, thereby preventing slipping of the saw in starting the incision. This was found in practice, however, to be unnecessary, the saw proving to be under perfect control.

The gauge to regulate the depth of cut of the saw slides at the side of the saw, and is accommodated in a dovetailed groove at the side of the handle.

The end of the gauge shaft is threaded and accommodates a nut set in a recess in the handle.

By turning this nut the gauge slides in or out and permits the saw to cut any depth to the finest fraction of an inch.

The saw is set in a recess in the handle and this, with the gauge just described, protects the operator's fingers perfectly from any injury.

The saw is attached to a short shaft held in place by a set-screw through the top of the nose piece of the handle. A thread on the other end of the shaft with a surrounding threaded collar, permits of connection with the flexible shaft and its sheath respectively of an electric motor or dental engine.

This instrument will cut as rapidly as desired through bone of any density. I have had the saw making 3,400 revolutions per minute with all vibration a negligible quantity.

It is appreciated that with a circular saw one must make incisions in a straight line. A moment's reflection will, however, show us that the curved incision has no real advantage, and is but an inheritance of the compulsory cut of the obsolete trephine.

We may secure with this instrument a bone flap of any dimension with the least possible amount of bone destruction and retaining, besides, the vitality of the flap.

Making a bone flap triangular in shape, then, instead of cutting through the last angle, snapping up this narrow tongue with a chisel, we preserve the periosteal connection and so the vitality of the bone.

If desired, by tilting the saw a beveled cut can be made, thereby securing a shelf and preventing any likelihood of undue sinking of the bone flap after replacement.

This instrument makes an incision of but one millimeter in width. It can readily be seen that this promises the very greatest likelihood of union occurring in the healing process.

Returning to the consideration of the guard upon the saw, inasmuch as the saw can be regulated to cut the finest shades of difference in depth, we have ample protection against injuring the brain substance. Even when there are internal ridges of bone if the operator does not choose to spring these loose with his chisel, he can pass a delicate curved probe around the ridge between the dura and the skull, and then pressing the dura away the saw can be used to cut the obstructing ridge with perfect impunity.

I have thus far refrained from referring to the inside guard, be-

cause I thought many surgeons would feel confident enough to control their cuts without its use. However, I have devised this guard, aiming to answer every requirement that might arise.

This guard is composed of the protecting arm with a T-shaped end, a pivot joint and a handle arm.

The joint is of the French lock pattern with a sufficiently wide bearing surface to prevent lateral motion. The French lock permits ready removal for placing the guard in position.

The handle arm turns up over the side of the instrument to the shoulder where it is operated by the thumb.

To operate this guard an opening is first made to admit the T-shaped tip, the tip is then adjusted in position between the skull and dura. It is attached to the instrument and the incision can be commenced, constant pressure of the thumb is necessary to keep the tip

Fig. 1.

in proper apposition to the inner wall of the skull. Suitable stops placed at the joint just prevent the arm from contact with the teeth and also unnecessary motion in the opposite direction.

A spring attached to the arm assists the thumb in constantly drawing up the tip toward the saw.* It is necessary to withdraw the tip and readjust when starting on a new line of incision as the narrow cut made prevents the guard from turning corners.

I might mention that a mechanism has been devised for transmitting the power through the handle to the short saw shaft. As, however, this mechanism is more complicated and less durable, and by experience the lateral transmission has not proven objectionable it has appeared wiser to use the simpler construction.

To sterilize the instrument here shown, it is only necessary to unthread and withdraw the guard, loosen the set-screw holding the shaft, and then draw out the saw and shaft. All the parts are then exposed and can be thoroughly cleansed.

* Not desiring to obscure the parts, the inner guard spring is not shown in Fig. 1.

In closing, I might say that though this saw was primarily devised for cranial surgery it will, no doubt, prove useful in various operations upon bones in other parts of the body. Its usefulness in removing the calvarium in post mortem work is apparent.

An instrument dealer who saw the plans, thought that this instrument would prove an admirable plaster of Paris cast saw.

DISCUSSION.

DR. JOHN B. ROBERTS: I quite agree with Dr. Masland that the saw, which appears to be very efficient, does not need a guard any more than the old-fashioned trephine needed one. In cutting through bone it is easy to tell by the feel when you get through. The rapidity with which the skull has been cut through shows how much the instrument would lessen the time of operation and reduce the time the patient is under ether.

DR. T. H. WEISENBURG: I am interested in cranial surgery from the standpoint of neurology. We have had in the University Hospital a large number of operations for the removal of brain tumors. I do not agree with Dr. Masland in several points. His instrument is so constructed that it would be impossible to make a cut deeper than one-quarter inch. It is well-known that the thickness of the cranial bones may be as much as one-half inch; I have seen a number of such instances. Again, the saw is so constructed that it would be almost impossible to make a continuous circular flap. Dr. Masland argues that a square flap is better than a circular one. In the operations we have had in the University Hospital, Dr. Frazier usually makes circular incisions. He recently opened the skull in an operation for brain tumor in the remarkable time of 2 minutes, using the dental engine. I do not see how this can be improved upon. A circular saw, which was attached to a dental engine similar to the one exhibited by Dr. Masland, was used by Dr. Edward Martin in an operation for cerebellar tumor. The only advantage that I see in this instrument is in the handle, which is adjusted so that it can be more readily used than the long thin shafts.

DR. MASLAND: I have been much interested in the instrument which Dr. Frazier uses at the University Hospital. It is called the Cryer instrument, though Cryer did not devise it, but a man named Brown. It consists of a drill with an inside guard. I learn that the incisions that the drill makes are one-eighth of an inch wide at least. In making a flap and allowing one-quarter of an inch for a cut, one-eighth on each side, you can readily see that when that bone is replaced it has not much of a shelf to rest upon. If there is any opportunity to sink it is going to do so with that width incision. There is also only a connective tissue union to withstand traumutism on the replaced bone. This instrument makes an incision but one millimeter in width and, if necessary, that can be diminished. The saw which I understand Dr. Martin used had no guard. It is a saw at the end of a handle and revolves without any guard or other protection as to depth of cut. Regarding the curved incision and the size of the cut, it can be seen that by making various shaped incisions any amount of space can be opened up and it is always possible to preserve a vital flap. The bone can be replaced; whether it would unite through the line of incision, we do not know. There would be a greater probability with an incision one millimeter in width compared with one one-eighth of an inch in width.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

SYMPOSIUM ON GASTRIC ULCER.

[February 8.]

The Etiology and Pathology of Gastric Ulcer.

By Joseph McFarland, M. D.

The form of gastric ulcer to which consideration is devoted in the following paper is that familiar to clinicians and pathologists under the name of simple ulcer of the stomach, round ulcer of the stomach, peptic ulcer, chronic perforating ulcer and Cruveilhier's disease.

Morbid Anatomy.—This form of ulcer is usually single, but may be multiple, as is shown in the following statistics of 463 cases collected by Brinton: Fifty-seven cases showed two ulcers, sixteen cases showed three ulcers, three cases showed four ulcers, two cases showed five ulcers, four cases showed more than five ulcers. There is a case on record in which thirty-four ulcers existed in the same stomach.

As a rule the ulcers are small in size, usually not more than one centimeter in diameter, though they vary within wide margins, and in rare cases may attain to the size of a saucer, one, reported by Peabody, having measured nineteen by ten centimeters.

The ulcers are usually nearly round, though in most cases one diameter slightly exceeds the other. The edges are always rounded, and when the shape is irregular, the irregularity may usually be explained by the coalescence of several ulcers.

They are most frequently situated on the posterior wall of the stomach near the lesser curvature. In Welch's 793 cases collected from hospital statistics, the following distribution was observed: lesser curvature, 288 cases, or 36 per cent.; posterior wall, 235 cases, or 30 per cent.; pylorus, ninety-five cases, or 12 per cent.; anterior wall, sixty-nine cases, or 9 per cent.; cardia, fifty cases, or 6 per cent.; fundus, twenty-nine cases, or 4 per cent.; greater curvature, twenty-seven cases, or 3 per cent.

Of 206 cases studied by Brinton, the following distribution was observed: posterior wall, eighty-seven cases, or 42 per cent.; lesser curvature, fifty-five cases, or 26.8 per cent.; pylorus, thirty-two cases, or 15.6 per cent.; anterior and posterior walls, thirteen cases, or 6.3 per cent.; anterior wall, ten cases, or 4.9 per cent.; greater curvature, five cases, or 2.4 per cent.; cardia, four cases, or 2.0 per cent.

Small ulcers are not infrequent in the duodenum, being usually situated close to the pyloric ring, in the first portion of the duodenum. These duodenal ulcers deserve separate mention, but these remarks refer especially to gastric ulcer.

The appearance of the ulcer is strikingly characteristic. The smooth rounded margins are, as a rule, without elevation. The surface is usually clean; that is, free from necrotic shreds, false membranes, etc. According to the classical description the lost tissue seems to have been cut out with a punch. The appearance of the ulcer will vary according to its depth. It may be limited to the mucosa, or may extend to the muscularis mucosæ, the submucosa, one or both muscular coats or actually reach the serous coat of the gastric wall. As the ulcer descends into the deeper tissues, the superficial extent of the denudation becomes less and less, so that the edges appear terraced. A close inspection will usually show the various circles or ovals to be slightly excentric, and the apex of the ulcer not exactly in the center. At the apex one is occasionally able to demonstrate a bloodvessel containing a thrombus, sometimes a bleeding vessel. The ulcer may be covered with a softened and blood-saturated mass, but is usually clean. Such ulcers may be supposed to have come to observation when progressing in size, and not tending to repair. When cicatrization begins, the edges become somewhat indurated, the margins of the ulcer less clear, the border wall sinuous and, as healing progresses, signs of contraction become more and more marked, until a smooth fibroconnective tissue cicatrix remains at a point where the mucous membrane is dimpled. The dimpling and thinning enable us to recognize the position of recovered ulcers for an indefinite length of time. When the ulcers are numerous or of large size, the cicatrization may be attended by a subsequent contraction by which the stomach is deformed. Thus, a centrally situated ulcer, such as that described by Peabody, when cicatrized may produce an hour-glass contraction. Large ulcers near the pylorus may cause the formation of a pouch, or obstruct the pylorus. The deeper ulcers not infrequently perforate, in consequence of mild traumatism, and it can readily be understood

how slight an injury may produce rupture of an ulcer closed only by the serosa.

Incidence.—Gastric Ulcer varies in frequency, according to the statistics of different writers, in different countries, and at different periods. In the statistics of Welch, already quoted, open or cicatrized ulcers were found in 5 per cent. of the autopsies held.

Miller and Starcke observed that ulcer of the stomach was very common in Thüringen, being found in 10 per cent. of the cases that came to autopsy. Grünfeld studied 450 autopsies in Copenhagen, and found ninety-two gastric ulcers; that is, 20 per cent. In Berlin gastric ulcer seems to be relatively infrequent. Berthold, whose observations extend between 1868 and 1872, studied 262 cases of ulcer of the stomach, being 2.7 per cent. of all the cases examined during those years The disease seems to be still less common in Munich, where Nolte observed 3,500 autopsies between 1876 and 1883, finding gastric ulcer only 43 times, or in 1.2 per cent. of the cases. Among the first thousand autopsies at the Johns Hopkins Hospital, Osler states that there were but 9 cases of ulcer of the stomach. Griess in Kiel, found ulcer of the stomach in 8.3 per cent. of cases examined; Ziemssen in Erlangen in 4.55 per cent.; Stahl in Zürich in 2.16 per cent.; Stark in Copenhagen in 13 percent.

I am sorry that I cannot give any accurate figures concerning the occurrence of gastric ulcer in Philadelphia. Unfortunately, the rich material of the Philadelphia General Hospital has never been systematically studied (until the work of Francine, reported to-night), and I can only say in a general way that ulcer of the stomach in that institution seems to be very rare, and that in a number of years' experience there, I have seen it very few times.

Most authors agree in finding the disease much more frequently in women than in men, but the proportions given vary greatly. Thus, Lebert in Breslau, found the proportion of men to women 3 or 4 to 1. In Zürich he found more cases occurring in women than in men. Brinton found the proportion of men to women 2 to 1; Stiner, 11 to 8; Wollmann found about the same proportion. With, in 291 cases observed, forty in men, a proportion of 7.3 to 1. Habershon in 201 cases of ulcer examined, found 127 in women and seventy-four in men; Anderson found only three cases out of thirty-five examined, in men; Danziger in Würzburg found the proportion of women to men 2 to 1; Riegel observed clinically 126 cases in men and 134 cases in women. He points out, however, that too much attention must not be paid to

such figures, for taking his cases by single years, the greatest variation could be observed. Thus, in 1884 he observed fifteen ulcers in men and eight in women. In 1887, seventeen in men and nineteen in women, and in 1886, twelve in men and twenty-six in women. So that chance must play an important role in the incidence of the disease. Of 1,699 cases collected by Welch, 40 per cent. were in men, and 60 per cent. in women.

The ulcers occur at all ages. Riegel summarizes 260 cases that he observed, as follows:

Age.	*Men.*	*Women.*	*Total.*
10 to 20 years	8	35	43
20 to 30 years	29	62	91
30 to 40 years	35	22	57
40 to 50 years	36	11	47
Over 50 years	18	4	22
	126	134	260

According to Lebert, about one-half of his 252 cases developed between childhood and the thirtieth year. He found the greatest mortality between the fortieth and sixtieth years. Habershon showed that the majority of 201 cases in male subjects occurred between forty and forty-five years, in females between twenty and thirty years. Riegel states that gastric ulcer is a rare occurrence in childhood. Among 262 cases of gastric ulcer examined post mortem, during fifteen years at the Berlin Pathologic Institute, there was no patient under ten years of age. Kundrat states that ulcers the size of millet seeds and lentils, and extending deeply into the tissue, are quite frequent in children. He believes these ulcers result from hemorrhage into the mucosa, and that the difference between such and the ordinary round ulcer is quantitative, not qualitative. He reports a case of ulcer in a child only a few days old, but admits that such ulcerations have never in his experience, developed into chronic ulcer in subjects under ten years of age. Henoch states that ulceration of the gastric mucosa is quite frequent in the newborn. Wertheimer observed a case in a child of ten years; Eross one in a girl of twelve years. Rehn has collected nine cases of simple ulcer in children. Goodhart has reported a case of ulcer of the stomach in an infant thirty hours old. According to Osler, ulcers of the stomach have been found in the fetus, and in the newborn shortly after birth. Martha Wollstein found five cases of gastric ulcer out of 390 autopsies at the Baby Hospital in New York

City. Code observed perforating ulcer of the stomach in a baby two months old. Hibbard observed it in a child four months old. Eleanor C. Jones has reported a case in a man eighty-four years old. It is interesting concerning this case to notice that the man thirty years previously had had a gastric disturbance, clinically diagnosticated peptic ulcer, and that at the autopsy an old scar, probably the result of that attack, was found near the fresh ulcer.

Occupation.—The relation of occupation to ulcer of the stomach is indefinite. Reliable statistics upon this subject seem not to be forthcoming. Cases occur in men and women in all walks of life; among professional men and women, officers, mechanics and day-laborers. It has been suggested by Habershon that occupations attended with pressure upon the abdomen predispose to gastric ulcer, as he found shoemakers, weavers and tailors, more frequently affected than others. For some time the opinion has been current that cooks are particularly predisposed to it, and it has even been suggested that the habit of tasting foods when very hot may have something to do with it. There is, however, insufficient statistical evidence to show that cooks do suffer from the disease more frequently than others, and Riegel with Nothnagel, disbelieves the statement that they furnish a disproportion of cases. Bouveret thinks that mirror polishers and metal workers are predisposed to gastric ulcer. Bernitz, that workers in porcelain swallow particles of dust that may be responsible for gastric ulcer.

Etiology (1) *The Traumatic Theory.*—Many writers claim that traumatism plays an important part in the development of gastric ulcer, and it may be convenient for consideration to divide such trauma into two groups; (a) internal, (b) external.

(a) *Internal trauma.*—Here we must mention the effect of temperature, which is held to be responsible for the development of gastric ulcer in cooks. Experiments have been performed by Decker, who fed hot gruel to dogs, and observed the loss of tissue with more or less destruction of the muscular layer of the stomach. The lesions found by Decker are, however, quite unlike the typical ulceration, and it is certainly not surprising that scalds of the gastric mucous membrane should be followed by its destruction. Riegel places no importance upon these experiments, and concludes that traumatic injuries of this kind are insufficient to produce typical ulcers.

Next must be considered such traumas as come from the ingestion of injurious substances, such as corrosive poisons, minute particles of

glass, metal, porcelain, etc. Bernitz believes that the frequent occurrence of the disease among workers in pottery and glass grinders, depends upon this cause, and Eichhorst observed that metal workers in Zurich frequently came to his clinic to be treated for gastric ulcer. Any or all of these substances may be capable of producing traumatic lesions of the mucous membrane, but the traumatic lesions so produced are quite unlike the typical gastric ulceration, and such traumatic lesions do not find their proper treatment under the heading "peptic ulcer of the stomach." One of the most striking instances of traumatic injury is found in the case reported by Marcet and mentioned by Ewald.

(b) *External trauma.*—In three cases the ulcer of the stomach is attributed to the pressure or injury of the abdomen by external objects. The first of these is the corset, and the number of cases among women appearing to be greater than among men, the corset was early put down as one of the responsible factors. The difference, however, in the number of cases certainly does not warrant such an assumption, nor do you find upon looking over the statistics of occupation in relation to gastric ulcer that have been published, that tailors, cobblers and others whose abdomens are subject to pressure, furnish a sufficient disproportion of cases to convince us of the validity of this claim. There are, however, a few striking examples on record. Ritter did a considerable amount of experimental work, striking dogs and other animals upon the epigastrium to determine the effects upon the stomach. Immediately after the trauma, the animals were killed and in one case a submucous hemorrhage was found, in another the mucosa was found separated from the submucosa. Ritter believes that such injuries predispose to the corrosion of the mucous membrane by the gastric juice, and thus lead to ulceration. This seems very reasonable, especially when we remember that the ulcerations occur most frequently in the lesser curvature of the stomach, which is usually injured when the organ is subjected to external violence. There is a difference, however, between the acute ulcers thus caused, and the classical ulcer of the stomach, which forms the subject of our consideration, for the traumatic injuries are followed by a rapid cicatrization, which is usually not observed in the typical round ulcer. Again, among the external traumatic lesions of the stomach must be mentioned those resulting from operative manipulation of the organ, in which healing usually takes place rapidly, and without corrosion of the tissue by the gastric juice.

Another class of traumatic injuries results from violent vomiting,

in which hemorrhagic infiltrations of the mucous membrane are not infrequent, and may be followed by the formation of ulcers. These conditions may not result from gastric disease, but from uremia, and from other morbid conditions associated with vomiting.

(2) *The Acid Theory.*—This teaches that the formation of gastric ulcers is due to an abnormal acidity of the gastric juice, which leads to corrosion or digestion of the mucous membrane and subjacent tissues. "Impossible," says Orth, "for then the digestive influence must be equally distributed over the entire mucous membrane, and not localized in a circumscribed area."

It is not impossible that hyperacidity of the gastric juice may interfere with the cicatrization of existing ulcer, or aid the enlargement of ulcers once formed, but that hyperacidity of the contents of the stomach can be responsible for so localized a lesion as gastric ulcer usually is, seems, to the writer, incredible. Moreover, gastric ulcer is not always associated with hyperacidity of the gastric contents, which must be the case should the hyperacidity be the cause of the ulceration. Riegel, in summarizing the literature upon hyperchlorhydria, concludes by saying that it does not lead to the development of chronic ulcer, but that it plays an important role in preventing its convalescence.

(3) *Alkaline Theory.*—Pavy was the first to teach that diminished alkalinity of the blood predisposed to attacks upon the mucous membrane of the stomach by its acid contents. This theory was based upon the belief that the stomach did not digest itself because of the alkalinity of the blood circulating in its walls, which neutralized the gastric juice in contact with the cells, and thus protected them. The fact that the ulceration is local must of itself be sufficient disproof of this theory so far as the general acidity of the blood is concerned. Just as hyperacidity, if the cause of ulceration, must cause digestion of the entire mucosa, so diminished alkalinity of the blood, if the cause of ulceration, must act uniformly upon the whole gastric wall, and not locally upon some part of it, and in so far as it can itself be the cause of ulcer, the theory may be dismissed.

(4) *The Hemorrhagic Theory.*—Rokitanski and subsequently Rindfleisch and Key, taught that ulcers of the stomach arise in consequence of hemorrhage followed by erosion. In discussing this theory Einhorn expresses himself very positively, that it is incorrect to believe that the difference between hemorrhagic erosion and ulcer is simply one of degree, and quotes Langerhans, in opposition to the theory on experience gained at autopsies. Einhorn also claims that the diagnosis of

erosion of the stomach can be made clinically, and that in none of his cases of hemorrhagic erosion of the stomach, did ulcer subsequently develop.

(5) *The Vascular Theory.*—Virchow was the first to teach that ulcerative disturbances of the gastric mucous membrane result from the obstruction of the small nutrient vessels by emboli or by thrombi, and that the anemic infarct, or in some cases the hemorrhagic infarct, thus produced is destroyed by the gastric juice, so that a circumscribed defect, corresponding in size to the obstructed vessel, is formed. The morbid anatomic indications of this are very clear. In many cases the obstructed nutrient vessel can be found. In other cases signs of hemorrhagic infarction may be detected in the gastric wall. The shape of the ulcer which is crateriform, the excentric position of the vessel, and of the destroyed area of the different layers of gastric tissue, all point quite definitely to this source of primary disease.

Virchow's view has been experimentally supported by Panum, who produced embolism of the gastric artery and saw typical ulcers in consequence. In many cases of gastric ulcer, however, no embolised or thrombosed arteries can be found in the neighborhood of the ulcer, and many clinicians and pathologists look upon this as evidence that none such exist.

(6) *Stagnation of the Gastric Contents.*—A. A. Berg has suggested that the formation of gastric ulcers depends upon the stagnation of food behind an obstructed pylorus and points out that ulcers of the bladder and other viscera follow obstruction. It is not impossible that ulcers may arise from such a condition, but in case of gastric ulcer as commonly observed, no such obstruction of the pylorus is present.

(7) *Nervous Theory.*—Dallavedova has advanced the theory that injuries and disease of the celiac plexus and splanchnics may be followed by hemorrhagic erosion and ulceration of the stomach, and Yzeren found that section of the vagus below the diaphragm produced gastric ulcer in ten out of twenty rabbits so treated. Some of these experimentally produced ulcers actually perforated. He believes the mechanism of their formation to be spasm of the pylorus followed by interstitial hemorrhage and corrosion by the gastric juice.

Talma applied faradic currents to the left pneumogastric nerves of rabbits so as to produce spasmodic contractions of the stomach, at the same time allowing solutions of hydochloric acid to flow into the stomach to excite a flow of gastric juice. Under these conditions ulcers developed. He thinks that the frequent occurrence of the ulcer near

the pylorus, where the stomach is most muscular, supports his view of their etiology.

Schiff and Ebstein induced gastric ulcers by injuries of the central nervous system.

(8) *Infection.*—Boettehn found colonies of micrococci about the base of gastric ulcers, but this observation is not in itself important.

Letulle isolated bacteria from the stools of a man suffering from dysentery with symptoms of gastric ulcer and found that pure cultures of the organism when introduced into guinea pigs produced specific erosions and ulcerations of the stomach. He also observed four cases of gastric ulcer in the course of suppurative processes. In one case of recent ulceration in the course of puerperal fever, he found streptococci in the veins of the submucosa and in the veins of the uterus. Injection of these streptococci into guinea-pigs was followed by the development of gastric ulcer. He thinks this infectious form of ulcer may result from surface infection should the cocci find an appropriate nidus, or through embolism of the gastric vessels.

Nauwerck also demonstrated that many peptic ulcers may be caused by mycotic influences.

Bouveret, however, points out that gastric ulcers are very rare sequelae of the infectious diseases, and believes that the experimental ulcerations differ from true round ulcer of the stomach.

CONCLUSIONS:—From the material thus brought together it seems justifiable to conclude that gastric ulcers may arise from numerous and very different causes, though in all probability such ulcers are not identical with those known to clinicians as the round ulcer or peptic ulcer.

The etiology of this particular lesion seems to require the cooperation of two factors; (1) the corrosive gastric juice and (2) a local loss of resisting power in the tissues with which the juice comes in contact. (1) *The gastric juice*, should our assumption regarding the diminished resisting power of the tissue be correct, need have no abnormal composition and need not be excessively acid, so that it can be dismissed as no more than an incidental factor in the production of the lesion. (2) *The lost resisting power of the tissue*, therefore, becomes the essential factor. This cannot be common to the whole gastric tissue, else the lesion could not be local. It must be focal and, therefore, must depend upon some condition operating upon a circumscribed area of the tissue. It seems very improbable that it can be traumatic since experimental, operative and accidental lesions of the stomach heal so kindly in most

cases. It must, therefore, be nutritional and vascular, whether the vascular disturbance depends upon traumatic injuries of minute vessels resulting from overdistention, pressure, embolism, thrombosis, infection, intoxication or defective innervation remains to be shown. It is not improbable that all of these have to do with particular cases.

The nature of the defective tissue resistance is obscure and will probably elude our efforts to discover it, as the normal immunity of tissue so long has done. In the light of our modern studies, one no longer refers the immunity of the gastric mucosa to the alkaline mucus that covers it or to the alkaline blood circulating in its capillaries. It is simply the immunity of the normal living tissue to its own products. So soon as the vitality of the tissue is disturbed, this immunity fails in part; when it is lost it disappears. If we refer the immunity of the stomach to the action of pepsin to the alkalinization of the hydrochloric acid by the blood salts, how shall we explain the immunity of the intestine to trypsin which is active in alkaline media? Both are due to the natural immunity of the respective cells to the respective enzymes, and the nature of this natural immunity is unknown.

Relation of Gastric Ulcer to Anemia.—So far no mention has been made of the association of gastric ulcer with anemia, though this association is too frequent to be accidental. When we have brought out this fact, however, we have said all that is certainly known and we are left in doubt whether the anemia—chlorosis—is the primary condition which predisposes to ulcer by inducing hyperchlorhydria as Riegel, in Nothnagel's system, seems to believe, or whether the chlorosis is the result of the malnutrition secondary to the gastric disturbance.

Course.—Unlike the experimental ulcerations produced by so many artificial means, round ulcer of the stomach usually shows little disposition to heal. Riegel and others attribute the chronicity to the irritative action of the hydrochloric acid upon the denuded tissues. This may be the case as hyperchlorhydria is so commonly associated with gastric ulcer, but can scarcely be so when operation wounds upon stomachs in which this condition exists commonly heal kindly. Whether this be the case or not it often requires months, and sometimes years, for complete cicatrization to occur. It does occur, however, and in many cases the ulcers form, persist for their usual length of time and heal without their existence being suspected.

Complications.—Two of these are important; (1) hemorrhage and (2) perforation. (1) *Hemorrhage* depends upon the erosion of a blood-vessel. What particular vessel must depend upon the position of the

ulcer, the depth to which it extends and its relation to and extension into other viscera. It may be unimportant when small vessels are opened, or may be fatal when good-sized arteries are eroded.

(2) *Perforation.*—This not infrequently takes place without symptoms, when preliminary adhesions form between the stomach and some neighboring viscus, or may at once pour out the gastric contents into the abdominal cavity, when it is a surgical complication calling for immediate interference. In more rare cases the gastric contents escape into the pleura or pericardium, the mediastinum or even into the lung.

Rarely, the portal vein being attacked, thrombosis occurs and septic infections of the associated organs with pyemia may supervene.

The Incidence of Gastric Ulcer in Philadelphia with Special Reference to the Post Mortem Records of The Philadelphia Hospital.*

BY ALBERT PHILIP FRANCINE, A.M., M.D.

The following figures from the analysis of the post mortem records at Blockley (the Philadelphia Hospital) were undertaken over a year ago at the request of Dr. Osler for Dr. C. P. Howard's paper on "The Incidence of Gastric Ulcer in America."[1] They were not, however, completed in time to be incorporated in that paper, so that I present them now as an additional side-light on this interesting subject. I entirely agree with Dr. Howard's statement that we cannot base accurate or conservative conclusions on data obtained from clinical observations, and for that reason have confined myself to autopsy records alone. The discrepancies in clinical figures are well illustrated in his paper, where he deals with the subject from that standpoint. To quote him: "The figures from Philadelphia are rather puzzling. The University Hospital returns, kindly furnished me by Dr. James Tyson, give 19 cases out of 3,979 admissions, or 0.48 per cent. On the other hand, the Pennsylvania Hospital has a very much smaller percentage—*i. e.*, 0.13. This discrepancy cannot be accounted for by any apparent reason." (Unless one takes into consideration the acknowledged uncertainty of the diagnosis in many instances, and the wide opportunity this offers for clinical error.)

* For complete paper see *Am. J. Med. Sci.*, March, 1905.

"In Baltimore we meet with similar anomalous figures. At the Johns Hopkins Hospital there have been only 70 cases of gastric ulcer out of 16,553 medical admissions for a period of about fifteen years. This gives a percentage of 0.42, which is below New York (0.44 per cent.), yet higher than Philadelphia (0.16 per cent.). But in striking contrast are the figures from St. Joseph's Hospital, Baltimore, giving 4 cases out of 3,298 medical admissions, or only 0.12 per cent. This, then, gives for Baltimore a percentage of 0.37 very far below New York and still farther below Montreal (0.92 per cent.) and Boston (1.28 per cent.)." These figures are interesting and, no doubt, in a sense, indicative of the relative frequency of gastric ulcer in the localities specified, but surely lacking in the accuracy of the post mortem figures given subsequently in the same paper as follows:

AUTOPSY PERCENTAGES.

City.	No. Autopsies.	No. Gastric Ulcers.	Per cent.
San Francisco,	551	13	2.35
Boston,	3,089	57	1.84
New York,	561	8	1.42
Philadelphia,	826	10	1.21
Montreal,	3,158	33	1.04
Cleveland,	433	4	0.92
Baltimore,	2,223	19	0.85
Total,	10,841	144	1.32

London	4.6 per cent.
Europe	8.54 "

The great difference in the total number of autopsies in the several cities strikes me as being also a probable source of fallacy in calculating the absolute and relative frequency of ulcer in the different localities. In some instances, notably in the case of San Francisco, New York and Cleveland, they seem to me too small in the aggregate to base a fair average upon. All such figures are, however, distinctly valuable, and bear out Dr. Howard's conclusions—*i. e.*, "1. Both clinically and pathologically ulcer is less frequent in America than in London and on the Continent. 2. That both clinically and pathologically, ulcer is more common in the northeastern than in the more southern regions of America, with the exception of San Francisco."

Militating against the view expressed above—*i. e.*, of the wisdom of using only post mortem records, are the opinions of Mayo,[3] who

thinks that acute gastric ulcer is by no means as rare as it is usually considered. He says that it must be recognized clinically, for it usually heals, and the treatment is purely medical. "It is altogether probable," he says, "that the vast majority of acute ulcers heal, but a considerable minority fail to do so and constitute a share of the chronic ulcers. A chronic ulcer is frequently, if not usually, chronic from its inception."

If it is true that the "vast majority" of acute ulcers heal, then the objections raised to the results of post mortem study on this subject by Byron Bramwell have increased weight. He thinks that acute ulcers often leave no scars and are not discovered at autopsy, or the scars, if present, are slight and often overlooked. So that a certain number of ulcers are overlooked in post mortem statistics. Admitting the likelihood of these fallacies in acute ulceration, I still consider autopsy records the much surer way of computing the absolute and relative frequency of gastric and duodenal ulcers, certainly of the chronic forms.

The generally accepted causes for gastric ulcer are anemia, hyperchlorhydia, certain occupations like shoe-making and tailoring, mechanical injury, the grinding action of the pyloric end of the stomach (Mayo), chlorosis and menstrual disorders, embolism and thrombosis (Virchow), as in heart disease or continued vomiting, extensive superficial burns, and lastly (and often rather casually mentioned), nephritis and tuberculosis. It will be seen from the statistics below that the great majority of these ulcers (which we must consider as the chronic forms) are associated with some chronic dyscrasic disease, as, for instance, nephritis or tuberculosis.

It will be seen in the accompanying cases that in almost if not quite every instance there was an associated condition (in 0.76 per cent. of the cases, nephritis or tuberculosis), to which in some manner we must consider the ulcers, usually multiple, etiologically related. So that I feel these two factors, nephritis and tuberculosis, should be emphasized more emphatically in text-book descriptions of gastric ulcer than is usually done.

In this connection, it would be interesting if we knew more about the relation of the stomach to chronic nephritis. Very little investigation has been done in regard to the perversions of gastric function in this relation, though such perversions are relatively frequent in nephritis. The investigations of Biernacki[8] seem to show that the secretion of gastric juice is in general reduced in all cases of inflam-

mation of the kidney. Occasionally hydrochloric acid was absent, especially in severe cases of nephritis, during the stage of edema, while it was present in milder cases, in large or small quantities. The secretion of pepsin was reduced, even in mild cases; while the motor power of the stomach was frequently found increased, not only in mild cases but also in old chronic cases. He thinks that the glandular function is inhibited by toxic metabolic products, and that organic changes take place in the stomach in those cases in which nephritis has persisted for a long time and in which the blood changes are considerable and the nutrition of all the tissues has suffered. It may well be that one of the results of this perversion of function is the chronic gastric ulcer.

Since the time of Cruveilhier[4] (1835), who first recognized this condition, there have been numerous and classical reports upon gastric and duodenal ulcer, both in France and Germany. Rokitansky[5] (1839) and v. Jaksch[6] (1843) published careful studies in relation to gastric ulcer, while Krauss[7] (1865), Chvostek[8] (1882) and Oppenheimer[9] (1891) have done the same in relation to duodenal ulcer. Indeed, following Cruveilhier's description, there have been in Europe, particularly Germany, an almost continuous series of experimental studies and reports contributing to our knowledge of these interesting morbid conditions. The foreign literature upon the subject is now enormous.

This has not, however, been the case in America, and accurate figures gleaned from autopsy records, while slowly making their appearance, as in Dr. Howard's valuable paper, are still all too scanty. So that any data, however inconsiderable, should, I feel, be welcome to those interested in scientific medicine.

[Here follows list of admissions to the medical wards of the Philadelphia General Hospital from January 1, 1893, to December 31, 1902; 39,542 cases in all. The autopsies during this period were 2,830.]

CONCLUSIONS. The following grouping shows the ulcers in relation to their apparent cause. Those in association with:

Chronic Nephritis. (2) 6.244; (4) 7.29; (8) 7.203; (12) 8.93; (13) 8.101; (18) 9.278; (20) 10.92; (22) 10.219; (23) 11.144; (30) 13.10; (31) 13.19; (32) 13.151; (33) 13.169; (34) 13.220; (35) 13.170; (37) 13.267; (40) 14.234. Total, 17; 16 gastric; 1 (20) 10.92 duodenal.

Tuberculosis, Miliary, or of Lungs. (1) 6.241; (3) 6.262; (5) 7.53; (6) 7.108; (7) 7.183; (11) 8.60; (19) 10.16; (28) 12.176; (29)

12.262; (36) 13.185; (38) 14.1; (42) 15.213. Total, 12; 11 gastric; I (7.183) duodenal.

Both Tuberculosis and Nephritis. (2) 10.147; (27) 12.154; (39) 14.71. Total, 3 gastric.

Chronic Bronchitis. (15) 9.8; gastric.

Pneumonia. (26) 12.55; gastric.

Atelectasis of Lung. (17) 9.259; both gastric and duodenal.

Carcinoma of Stomach or Elsewhere. (9) 7.269; (14) 8.274; (16) 9.123; (41) 15.129; Total, 4; all gastric.

Heart, Fatty. (10) 7.270; both gastric and duodenal.

Enterocolitis in Infants. (24) 10.286; (25) 10.295; both gastric. (Extensive superficial burns, with tuberculosis and nephritis. (27) 12.154. Classified above under tuberculosis and nephritis.)

Grand total, 42; total gastric, 38; total duodenal, 2; both gastric and duodenal, 2.

In 20 out of 42 cases, or 0.47 per cent., the ulcers were multiple. Mayo says that in 20 per cent. of cases more than one ulcer is present. Brinton,[10] in 463 autopsies upon cases with ulcer of the stomach, found 57 with two ulcers, 16 with three or four, 2 with five, and 4 with more than five.

The sexes in the above series were equally divided, there being 21 males and 21 females, and the average age for the males was forty-three years, and for the females the same, a remarkably equal distribution. Welch, in his statistics, found 40 per cent. in males and 60 per cent. in females. The largest number of cases in his series occurred in males between thirty and forty years, and in females between twenty and thirty years, but there was much uniformity in the distribution in relation to the four decades. In my series the greatest number of cases occurred in males, 5, between fifty and sixty years, and in females, 5, between forty and fifty years. Here, too, there was a tolerable uniformity in relation to the four decades. Three of the cases were in infants ten, twenty and thirty-six months old, respectively. Dr. Osler mentions a case reported by Goodhart in an infant thirty hours old.

It should be borne in mind in relation to these figures that the age given is the age of death and not the age of the incidence of the ulcer, which must be considered as occurring earlier.

In regard to size, Dr. Osler mentions an ulcer 19 cm. by 10 cm., reported by Peabody, as the largest one he knows of. The largest one in my series (No. 28) was 9 cm. to 10 cm. by 8 cm. to 10 cm. The same

authority refers to a case reported by Berthold in which there were 34 small ulcers. Similar cases of multiple ulcers are seen in my cases Nos. 10 and 32 above.

It should be remembered in basing conclusions on the above figures that the lame, the halt and the blind of the city's streets sooner or later find their way to the Philadelphia Hospital and Almshouse, and that it is preeminently the house of chronic invalidism and disease.

Dr. Joseph Walsh, late pathologist to the Henry Phipps Institute, tells me that during his service (1903) there were 52 autopsies on those dead of tuberculosis, and that in one case he found numerous small superficial ulcers in the stomach. Dr. Rosenberger, who followed him, says that during the year 1904 there were 55 autopsies and no instance of gastric nor duodenal ulceration.

To briefly recapitulate, the total number of medical admissions to the Philadelphia Hospital for ten years from January 1, 1893, to December 31, 1902, inclusive, was 39,542. The total number of autopsies was 2,830. The total number of ulcers was 42, of which 2 were purely duodenal.

SUMMARY:

Hospitals.	No. of Autopsies.	No. Gastric Ulcers.	Percentage.
Philadelphia General,	2,830	40	1.41
Pennsylvania,	547	7	1.28
University,	279	3	1.07
Henry Phipps Institute,	107	1	.94
City of Philadelphia,	3,763	51	1.35

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Symptomatology and Diagnosis of Gastric Ulcer.

BY CAMPBELL P. HOWARD, A. B., M. D., of Baltimore, Md.

[By invitation.]

There are few diseases that are so obscure and misleading as the one under consideration. Few have received so much attention in the medical literature of our time.

It is impossible to present to this Society anything new or original on so stereotyped a subject. Therefore, I crave the indulgence of my audience at the apparently unnecessary repetition of facts familiar to all.

The mode of onset in the great majority of cases is gradual and insidious, the patient being unable to state exactly when the first symptoms appeared. In a smaller group the onset of hematemesis or perforation is sudden and abrupt. The latter is to be distinguished from the "latent form" of the chronic ulcer by the pathologic findings, which are those of an acute process. Fenwick was the first to divide, clinically, round ulcer into the acute and chronic varieties. In spite of the many objections raised, we believe that this distinction can be made.

(*A.*) *Acute Ulcer.*—The "acute ulcer may either occur as a primary disease or develop in a more or less accidental manner during the course of some other disorder." [1]

The Acute Primary Ulcer, known as the "Acute Perforating Ulcer of Young Adults," is especially frequent in women, and may have, as its earliest symptom, hematemesis, owing to the fact that the ulcer is usually situated on the lesser curvature and is then extremely apt to erode a branch of the coronary artery. If the ulcer be situated on the anterior wall, where there are fewer vessels, perforation may be the first indication.

Hemorrhage was found by Fenwick to occur as the first symptom in 75 per cent. of the cases. It is sudden and profuse, usually following physical exertion or the ingestion of a meal. Another feature is its rapid cessation, owing to the absence of fibrous tissue which inhibits the contraction of the bleeding vessels in the chronic variety. The usual symptoms of internal hemorrhage (vertigo, faintness, air hunger, restlessness, rapid pulse) will be present. As a rule the blood is vomited and only in rare instances is the blood passed by the bowel without appearing in the vomitus. A mild pyrexia may follow a moderate hemorrhage.

Pain after food is not so frequent as in the chronic form, nor is it usually any more than that of ordinary "indigestion." A severe pain was present in only 7 per cent. of the acute cases of Fenwick. It depends upon the ingestion of food and is relieved by vomiting, but never to be the same extent as in chronic ulcer.

Vomiting is the exception and not the rule, though nausea and pyrosis are frequent.

Perforation of the stomach, according to Fenwick, is the first symptom in about 3 per cent. of the cases. As a general rule, this accident is preceded for three or four days by severe pain in the epigastrium, increased by food or exercise. If the stomach be empty at the time of the accident, and the ulcer be situated on the lesser curvature, local peritonitis only will result. If, however, the stomach be distended with food and gas and the ulcer be on the greater curvature or the anterior wall, a general peritonitis will develop.

The Acute Secondary Ulcer occurs under the three following conditions:—(1) pyemia and septicemia; (2) portal obstruction; (3) direct traumatism. These do not concern us.

(*B.*) *Chronic Ulcer.*—Let us briefly discuss the points of interest of the three cardinal symptoms of chronic gastric ulcer;—viz., pain, vomiting and hematemesis.

Pain is usually the most constant feature, being present in 80 to 100 per cent. of the cases. It indicates an active ulcer or its sequelæ. Leube holds that only in very rare instances do cicatrices cause pain. The situation of the pain does not indicate the site of the ulcer, as was first thought by Brinton. As a rule it is strictly localized to the epigastrium in the median line about one inch below the tip of the xiphoid cartilage, but may occur in any situation from either shoulder blade to either iliac fossa. It is as a rule severe, though it may not exceed that of hyperchlorhydria. It has been variously described as "burning," "gnawing" or "tearing." It is paroxysmal in character, following the ingestion of food, persisting throughout digestion, reaching its maximum two or three hours after the meal, and almost immediately relieved by vomiting. Continuous pain means localized peritonitis around the base of the ulcer. In cases in which the ulcer is situated near the plyorus and is adherent to the pancreas, pain occurs in the intervals of digestion and is relieved by food. Pain is usually increased by pressure but may be relieved. Again the intensity may vary with posture, but this is no certain indication of the site of the ulcer. Mental emotions, menstruation, etc., sometimes influence the pain. It is

invariably lessened by hemorrhage from the relief of tension afforded. There are three probable factors in the causation of the pain: (1) the direct irritation of the ulcer by food; (2) the peristaltic movements during digestion; (3) the hyperchlorhydria when present.

Vomiting is less constant than pain, though the reverse was true in the Boston and Baltimore series. There is a close relation between the severity of the pain and emesis. The latter usually occurs at the height of the paroxysm of pain; less frequently imediately after eating. The time at which vomiting occurs may give some clue to the condition of the ulcer: thus (1) when merely due to an uncomplicated ulcer, vomiting occurs in from one-quarter to two hours after meals; (2) in chronic pyloric ulcer with adhesions to the pancreas or liver, vomiting may occur during the night or in the intervals of digestion; (3) when stenosis of a slight degree has resulted, vomiting occurs about two hours after food: but as soon as ectasy develops, emesis is repeated at irregular intervals. Vomiting may be the direct cause of death from the consequent anemia, loss of flesh and general debility, all of which predispose to some secondary infection, as tuberculosis. As digestion is not retarded, but more often hastened, the vomitus consists of small amounts of fine particles of food with an acid odor and taste. In some patients there is an entire absence of vomiting, though this is never the case when an orifice of the stomach is involved.

Hemorrhage.—It is very probable that in every case of gastric ulcer there is some hemorrhage, though in by no means all does it manifest itself macroscopically in the vomitus or stools. This symptom may not appear for months or even years after the onset of the cardialgia, as the morbid process is *sui generis* a slow one. The bleeding occurs usually after a meal owing to the subsequent congestion with stretching of the walls of the stomach by the gastric contents. Other causes for the onset of hemorrhage are severe vomiting, straining at stool, menstruation and, less commonly, the passage of the stomach tube. From the latter we have had no case of alarming hemorrhage, though on one or two occasions small amounts of blood have been expressed with the stomach contents. In about 75 per cent. of the cases, the hematemesis is followed by melena. Hosslin believed that only when the hemorrhage amounts to 500 cc. do tarry stools result. In such a case the stools are of a uniform brown black color with a shiny surface. Very occasionally there is no hematemesis, but merely melena, though this is more often true of the acute variety. Further, severe, even fatal hemorrhages, may occur without external evidence. This "*l'hem-*

orrhagie foudroyante" is always due to the erosion of a large artery and occurs in from 3 to 5 per cent. of the cases. Fränkel has reported a case in which profuse hemorrhage was due to small capillary erosions of the gastric mucosa. Slight and moderate hemorrhages are apt to occur, a fact which is largely due, according to Moynihan, to the distension and stretching of the walls of the stomach from gas, as was found by him in fifteen out of sixteen patients operated on for gastric hemorrhage.

Dyspeptic Symptoms.—Many patients suffer from symptoms arising from functional disorder of the digestive organs, such as discomfort after meals, flatulence, acidity, nausea and constipation. The appetite is usually good, but, as was pointed out by Gerhardt, the patient is afraid to eat because he fears the resulting pain. If hyperacidity be present there may be actual bulimia.

The General Health is usually good in the early stages of the disease. but after a protracted course there are emaciation, anemia and general neurasthenic symptoms. The loss in weight may be very considerable, which with the pallor may give rise to the suspicion of carcinoma. In our Baltimore series[3] of eighty-two cases there were thirty-six patients who lost ten pounds or more and there were nine who lost forty pounds or over. Anemia will occur when there is much loss of blood, especially in those with frequent small hemorrhages.

Amenorrhea is uncommon in the chronic form of gastric ulcer. The irritability and mental depression are due to the constant suffering and may develop into actual melancholia. These may mask the primary condition entirely.

Mild fever does occur following large hemorrhages, but, with this exception, is an indication of some complication or associated condition.

Physical examination is entirely negative in uncomplicated cases, with the exception of more or less definite areas of tenderness.

A palpable *tumor*, while comparatively rare, may be present under certain conditions. These Gerhardt enumerates as follows: (1) the thickened base and plate-like margin of the ulcer itself, especially when situated on the anterior wall; (2) functional hypertrophy of the pyloric musculature due to the spasmodic contractures of the stomach and hyperacidity; (3) localized exudate in the neighborhood of the ulcer following perforation; (4) old large ulcers forming adhesions between neighboring organs, as the pancreas, left lobe of liver, gall bladder. Fenwick adds another rare condition; viz., enlarged pyloric

glands. By far the most frequent causes are the hypertrophy of the pylorus and adhesions to neighboring viscera.

Dilation of the stomach in an ulcer case signifies pyloric obstruction either *directly* from the ulcer or its scar or perigastric adhesions or *indirectly* from constriction or spasm of the pylorus from mechanical irritation.

Gastric Analysis, as a rule, shows that the time of digestion is reduced owing to the presence of hyperchlorhydria. The latter is usually stated to occur in 75 per cent. of all cases. Ewald, Gerhardt and Drechsfeld have not found hyperchlorhydria to be the rule, nor did we in the Johns Hopkins Hospital. This great variation in the results of gastric analysis depends, no doubt, on two main factors; in the first place, the periodicity in the occurrence of hyperacidity; and in the second, as Fischer[4] has recently pointed out, upon the Ewald test breakfast itself. The latter does not give a fair conception of the gastric secretion, because, first, it fails to excite the appetite, second, it is not a sufficient physical and chemical stimulant, and third, because it places the individual in unnatural conditions. Fischer, therefore, recommends an addition to the Ewald breakfast of one-quarter of a pound of finely chopped, seasoned beef. There should be no objection to the examination of the gastric contents, as according to Riegel[5] there is less danger in the use of a soft stomach tube than in the violent vomiting so frequently seen. A statement with which we fully concur.

A discussion of the *complications* and *sequelæ* of gastric ulcer is not within the province of this paper.

Diagnosis.—There are few diseases which present more difficulties in making a diagnosis than gastric ulcer. In the first place, the disease may run an absolutely latent course until death ensues either from some intercurrent affection or from one or other of the complications or sequelæ of the ulcer itself. Again, a diagnosis may have to be made purely upon the subjective symptoms of the patient, or what is very little better, upon a history of vomiting of blood. Patients' statements in the vast majority of cases are absolutely unreliable. It is so easy for the untrained eye, nay, even the trained, to mistake for blood various pigments in the vomitus or stools. Further, no *single* symptom, even hematemesis, is diagnostic. There are three symptoms necessary to determine the presence of an ulcer; (1) pain felt in a localized area on palpation or recurring in paroxysms depending upon meals, (2) hematemesis, (3) hyperchlorhydria. If one or other of

these be absent, the diagnosis is considered in doubt by many. Yet, as we have already pointed out, hyperchlorhydria is by no means the rule.

In regard to vomiting of blood, many physicians consider it a positive sign. But we first have to establish the fact that the suspected material is blood. This is easy when the hemorrhage is bright red in color or in dark clots. However, when the amount is small and the blood has been acted upon by the gastric juice, the difficulty arises. Microscopic examination may reveal the presence of red corpuscles or their shadows. If this be negative, one has to resort to some chemical test. Einhorn[5] and others recommend Weber's Test for this object, and especially for the detection of occult or concealed hemorrhages in apparently normal stools. It consists in mixing the suspected material with a few cubic centimeters of glacial acetic acid and then shaking thoroughly with sulphuric ether. If blood be present, the extract becomes a Tokay wine color. If the color be not distinct, add to the above ethereal extract equal parts of tincture of guiacum and ozonized oil of turpentine: a bluish violet color will result if hemoglobin be present, a reddish brown if absent. Raw or even boiled meat may cause this reaction. Now having determined the presence of blood, we have to exclude other possible sources than simple ulcer, as the carcinomatous and tuberculous forms or even simple erosions: also varices in cirrhosis of the liver, and hemorrhage from the buccal cavity. The differentiation from hemoptysis is usually easy, as in the latter the blood is coughed up, is bright red, mixed with air and of alkaline reaction.

Ewald and Watson have each reported a case of vicarious menstruation in which the patient vomited blood regularly at every 'period' and at no other time. The presence of a tumor usually speaks for carcinoma, yet Gerhardt believes that if a disease of the stomach has persisted uninterruptedly for more than three years, the presence of a small thin tumor is greatly in favor of ulcer. One must always bear in mind the possibility of a carcinoma developing upon the base of an ulcer, a condition which is rarer than many recent writers would lead us to believe. In ulcus carcinomatosum there is at first little or no decrease in the quantity of hydrochloric acid and later a gradual reduction. Lastly, we must bear in mind that pyloric obstruction from ulcer or its scar may give rise to subacidity with even the presence of lactic acid and Oppler-Boas bacilli.

The following points would suggest *carcinoma ventriculi*; (1) when

the constitutional symptoms precede the local phenomena, (2) presence of anorexia, (3) pain when present is more constant and lancinating in character, (4) vomitus contains undigested food and lactic acid.

From *duodenal ulcer* it is often impossible to differentiate, and, as a rule, is unnecessary, as the treatment is identical. Mayo and Graham[6] have recently found that the stomach was also involved in 5 per cent. of their duodenal ulcer cases. The following are points in favor of duodenal ulcer; (1) more common in men at a later age, (2) pain is further to right of median line and occurs later after food, (3) absence of vomiting, (4) melena rather than hematemesis.

From *gastric erosions* Einhorn differentiates ulcer by the following data; (1) burning pain in the entire gastric region uninfluenced by pressure or posture, (2) presence of shreds of gastric mucosa in the washings.

From *cholelithiasis* the diagnosis is easy on account of (1) paroxysmal pain, radiating toward the right, independent of meals and with out any regularity; (2) tenderness in the region of the gall bladder, owing to enlargement of the latter or of the liver itself; (3) presence of jaundice in some cases.

The various forms of *nervous gastralgia* will cause some difficulty unless one considers the following points: (1) general nervous symptoms in addition to the local ones; (2) the irregularity and variability of the appetite; (3) the absence of hematemesis, (4) the disappearance of pain, according to Leube, upon the application of the electric current during digestion. Intercostal neuralgia, gastric crises and movable kidney should offer no difficulties. To determine the *site of the ulcer* is a more difficult problem and can *rarely* be accomplished. According to Gerhardt, pain on pressure with the presence of a tumor indicates the anterior wall as the site; pain in the back and hemorrhage, the posterior wall. The effect of either lateral decubitus upon the exacerbation and location of the pain may aid, according to some, in differentiating between ulcer of the fundus from that of the pylorus.

Finally, in rendering a diagnosis of gastric ulcer one must not neglect to determine the presence of a complication as ectasia ventriculi, hourglass stomach or perigastric adhesions.

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The Medical Treatment of Gastric Ulcer.

BY FREDERICK P. HENRY, A. M., M. D.

It needs no detailed demonstration to prove that gastric ulcer is curable. In fact, the frequent observation of characteristic cicatrices in the stomachs of individuals who, during life, may have manifested no severe symptoms or signs of gastric disorder shows that the tendency of the disease is toward recovery. The object of treatment, therefore, is to assist nature in her effort to cure. The most important indication is rest, both general and local. This is fulfilled by putting the patient to bed and nourishing him with rectal enemata. The following mixture has been found by Ewald to answer every purpose of rectal feeding. Two or three eggs are beaten up with a tablespoonful of cold water. A small quantity (*eine Messerspitze*) of starch is then boiled with half a cupful of a 20 per cent. solution of grape sugar to which is added a wineglassful of claret or red Rhine wine. The egg mixture is now slowly added, taking care that the fluid is not hot enough to coagulate the albumen. This nutritive enema, which should not amount to more than eight ounces, should be preceded by one of simple water containing a little salt in order to cleanse the rectum preliminary to its digestive performance. Such a mixture as that just described may be administered for a considerable period without causing undue irritation provided it be introduced as high up as possible and slowly injected. Ewald's rule is to continue the enemata for three days and then to begin the administration of food by the mouth; but, if the strength permits, it is safer to continue to nourish the patient exclusively by the rectum for at least one week, the sense of hunger, if acute, being obtunded by opium which also relieves any pain that may be present, quiets the muscular layer of the stomach and prevents or allays vomiting. No absolute rule can be laid down with reference to the time during which rectal nourishment may be continued with the greatest advantage. This manifestly depends to a great extent upon the general condition of the patient and the tolerance of his rectum.

There are probably also decided individual variations with reference to the digestive and absorbent powers of this part of the intestine. When nourishment *per os* is resumed, it should be of the blandest character, consisting, at first, entirely of either milk or gruel. If milk is well tolerated it may constitute the sole article of diet for one, two, or more weeks. It should be administered warm and mixed with

lime water in the proportion of half an ounce of lime water to four or six ounces of milk, or, if the gastric secretions are very acid, a little sodium bicarbonate may be added. It is preferable, however, to increase the proportion of lime water as the evolution of gas which follows the exbihition of the sodium bicarbonate might distend the stomach to an injurious extent. In some cases milk is better digested when boiled. If the milk is found to coagulate in hard curds which are vomited or to disagree with the patient in other ways, a trial may be made of buttermilk which is an excellent succedaneum. The formation of hard, indigestible curd in a hyperacid stomach may sometimes be prevented by adding to the milk a little flour previously well boiled with milk or water or a small quantity of oatmeal or cornmeal gruel or, finally, the milk may be peptonized. Raw or soft-boiled eggs, beef, mutton, and chicken broths and good preparations of beef peptone, are excellent articles of diet in these cases. The approaches are thus made toward a solid diet which is not resumed until several weeks after the beginning of treatment. Even then, the greatest care must be taken for months afterward to exclude indigestible articles.

The medicinal treatment of gastric ulcer, while of secondary importance is, in my opinion, conducive to the healing process. There is a general belief, based upon careful clinical observation, in the value of bismuth subnitrate in this disease. It exerts a sedative action upon the stomach, neutralizes acidity and possibly, as some hold, forms a protective coating upon the surface of the ulcer. It should be administered in decided doses, at least half a dram being taken thrice daily. It seems to me superfluous to administer such large doses as three drams at a time; although good results are claimed for this heroic method of prescribing. The bismuth is best given suspended in barley water or mucilage. Benefit has been apparently derived from the use of silver nitrate, although it would seem more sensible to administer the chlorid. In the hyperacid secretions of gastric ulcer the nitrate must be immediately converted into the chlorid of silver. Pain, when severe, demands morphin or some other derivative of opium. Vomiting is best overcome by total abstinence from food by the mouth, by the hpyodermic use of morphin and by small doses of cocain hydrochlorate. Hematemesis is met by the hypodermic injection of ergot or adrenalin and the ingestion of small pieces of ice, conjoined with absolute rest, both general and local. Gallic acid and lead acetate are also of value in such cases. The springs of Carlsbad enjoy a well

earned reputation for the cure of gastric ulcer and many a patient afflicted with the disease has had reason to rejoice at having gone to this Mecca of dyspeptics. It is probable, however, that those who are unable to make this pilgrimage may derive quite as much benefit from the use of Carlsbad water in their own homes which offer so many collateral advantages. I fully agree with Ewald in the opinion that the good results attendant upon a stay at Carlsbad are largely due to the strict dietetic rules there enforced. The laxative effect of Carlsbad water is undoubtedly beneficial and may be obtained by giving from one to four drams of the salt in a pint of water, the entire quantity being slowly consumed during the hour preceding the morning meal. Other purgatives should be used with great caution, especially mercury which was believed tby Brinton[1] to be of decided injury. "A single calomel purgative," says this well known authority, "has even appeared to undo all that months of sedulous treatment had been able to effect toward the relief of a gastric ulcer."

The frequent coincidence of gastric ulcer with chlorosis and other forms of anemia is notorious and, therefore, after the acute symptoms have subsided, attempts should be made to improve the condition of the blood with some bland preparation of iron. There is none better, under the circumstances, than the albuminate which may be given as manufactured by the chemist or prepared extemporaneously after the following formula of Ewald. A 2-3 per cent. solution of iron sesquichlorid is made and of this one teaspoonful is taken thrice daily mingled with a wineglassful of egg-water: i. e. with a solution of albumin made by adding one part of white of egg to two parts of water.

In a comparatively recent publication, Leube[2] gives the details of his method of treating gastric ulcer during a period of fifteen years, and discusses the indications for surgical interference. His communication is of great value, both because of his world-wide authority on the subject of gastric disorders and especially on account of the fact that, during the period mentioned, he had under his care more than a thousand cases of gastric ulcer. The chief features of Leube's method consist in the systematic use of poultices and cold water compresses, the internal use of Carlsbad water and a carefully regulated diet. Medication is altogether secondary and in many cases is not resorted to. Rest in bed, it is scarcely necessary to say, is an important feature of the "cure." The mere haphazard employment of the above-mentioned measures does not warrant the claim that Leube's method has either succeeded or failed in any given case. The directions for

their employment are minute and since his success has been remarkable, they deserve the most careful attention.

The patient is put to bed and kept there for ten days. On the first day the epigastrium is carefully washed with alcohol and sublimate solution; an ointment of boric acid spread upon a cloth is then applied to the same region, and over the cloth a hot flaxseed poultice about 20 cm. long by 10 cm. wide. The poultice is changed every fifteen minutes and is kept applied for from ten to twelve hours during the day. At night a cold water compress is substituted for the poultice, the cloth spread with ointment being interposed between the compress and the integument. The boric ointment dressing is changed but once in the twenty-four hours. An occasional effect of these continued hot applications is the formation of vesicles which rarely suppurate and invariably heal as soon as the dressings are discontinued. As a result of this topical treatment both the gastric pain and the epigastric tenderness disappear with remarkably regularity, about the fifth day. In the exceptional cases in which the pain persists the poultices are continued (during the day) for five days after it has ceased. From the above it is evident that, in the majority of cases, the poulticing is kept up for ten days. After the cessation of the poulticing a cold water compress is applied at night for three weeks while, during the day, the patient wears an abdominal bandage of flannel. After meals during the convalescent period, rest in the recumbent posture for one or two hours is enforced, and the patient is strictly forbidden to make any exertion or to pursue any occupation, such as sewing or knitting, which involves the bending forward of the trunk.

There are certain contraindications to the employment of poultices one of which is the recent occurrence of gastric hemorrhage. Leube's rule is not to apply poultices unless three months have elapsed since the last hemorrhage. In such cases the cold water compress is substituted and even this is withheld unless eight days have passed without hemorrhage. The term hemorrhage, be it remembered, is not synonymous with hematemesis. To determine the presence or absence of hemorrhage, the feces should be carefully inspected. When hemorrhage is present at the beginning of the treatment or within eight days thereof, an ice bladder is first applied, to be replaced later by the cold water compress. Another contraindication to the employment of poultices is the occurrence of menstruation.

From the beginning of the course of treatment the patient is placed upon the use of Carlsbad water which should be swallowed in

the morning before breakfast with pauses between each mouthful. The water should be neither too hot nor too cold, (35° to 38° C.) and the average quantity thus taken should be about one-fourth of a liter. In cases of extreme acidity the amount may be increased to one-half liter. From ten to fifteen minutes should be occupied in swallowing the water. The use of the Carlsbad water is continued for four weeks and for quenching the thirst during the day, a slightly alkaline water such as the natural "*Selters wasser*," should be used. Drugs, as already stated, are not employed, as a rule, but when pain is severe, sodium bicarbonate or bismuth may be administered. Narcotics, such as opium and its preparations, including codein, are never prescribed. In cases of obstinate constipation enemata of tepid water may be employed daily, and every two or three days a dose of Carlsbad salt. After the eleventh day constipation may be relieved by a teaspoonful of a powder composed of powdered rhubarb, 20.0; sodium sulphate, 15; sodium bicarbonate, 7.5.

The third important factor in the treatment is the diet. Nourishment is administered five times daily and during the first ten days, i. e. during the period of poulticing and rest in bed, is composed of boiled milk. Leube's meat solution and softened, unsweetened zwieback. The following week there is added to this dietary soups made of rice or sago thoroughly softened by boiling in milk with white of egg, raw or soft boiled eggs, calf's brain and boiled chicken. Other tender meats are gradually added and after the fifth week, the diet of health is resumed although, as a matter of course, more than ordinary care should be taken to avoid indigestible articles of food.

The number of cases in which Leube has carried out this treatment in 556, of which 63 were private patients and 493 hospital patients; 116 were men and 360 were women; the proportion of women to men being, therefore, about 2 to 1. The ordinary mortality of gastric ulcer is about 13 per cent., of which 6 to 7 per cent. is due to perforation, and 3 to 5 per cent. to hemorrhage. Out of Leube's 556 cases only 12 died, i. e. 2.2 per cent. of which 6 died of perforation and 6 from uncontrollable hemorrhage. In 69 of the cases the method was not carried out in all its rigor, the patients leaving the hospital before the cure was complete. This leaves 424 cases of which 314 (74.1 per cent.) were cured; 93 (21.9 per cent.) were improved; 7 (1.6 per cent.) were not relieved and 10 (2.4 per cent.) died.

It may be objected that in some of these cases the diagnosis of gastric ulcer was incorrect. With reference to this point Leube states

that in 46 per cent. of his cases there was gastric hemorrhage and further that in only one case was his diagnosis of gastric ulcer refuted by autopsy. The case in question was a hysterical woman who complained of great pain and tenderness in the epigastrium and vomited blood. She died suddenly of pneumonia and at the autopsy the mucous membrane of the stomach was found intact.

With such results as these, Leube's claim that in from 75 to 96 per cent. of the cases of gastric ulcer surgery is uncalled for, seems to be fully established. In 75 per cent. surgery is meddlesome because this percentage is cured by a single course of the treatment above outlined. In the remaining 21 per cent. which represents the cases merely benefited by a single course of the treatment, the method should be repeated once, twice or even three times before considering the question of operation

I have employed Leube's method in modified form in a sufficient number of cases to convince me of its efficacy. My modification consists in nourishing the patient, during the first week of treatment, either entirely or partially by rectal enemata, and in the *pro re nata* employment of opium and its derivatives. I can see nothing but advantage in the judicious employment of opiates in gastric ulcer.

I wish, in conclusion, to emphasize the importance of system in the treatment of disease: system based upon a thorough knowledge of the disease process, whatever it may be. System has accomplished wonders in neurology, in enteric fever and, as we have just seen, in one of the most serious diseases of the stomach. It is system that has made the success of the Spas of Europe and this country, and the most successful system is the one which, like that of Leube, is not stereotyped but, on the contrary, is sufficiently elastic to adapt itself to the individual case.

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The Surgical Treatment of Gastric Ulcer.

BY WILLIAM L. RODMAN, M. D.

The surgical treatment of gastric ulcer resolves itself into the treatment of the ulcer itself and its several complications. Concerning some of the latter, notably perforation and subphrenic abcess, surgical opinion has already crystallized. Concerning other complications as hemorrhage, unusual pain, excessive vomiting, it is crystallizing, whereas the treatment of simple, uncomplicated ulcer has yet to be crystallized. Perforation and subphrenic abcess should always be met by prompt operation. Perforation may be classified as acute, subacute and chronic. By acute perforation is meant sudden rupture of an ulcer with the stomach full of food and drink. There is no previous warning, no adhesions have been formed and death is practically certain without laparotomy. It often occurs in connection with the latent ulcer. I recently saw two well marked instances of the kind in a single week. In neither case had the diagnosis of ulcer been made by the excellent physicians in attendance.

One was in the case of a young man, aged 22 years, who was suddenly seized with all the symptoms of shock and perforation at 4.30 P. M. Laparotomy was done at 9 P. M. An opening admitting the point of a finger was found on the anterior wall of the pylorus through which was escaping gas, milk and other gastric contents. Recovery took place after a stormy convalescence in which there seemed to be undoubtedly extensive local if not indeed a general peritonitis.

The second case occurred at 1 A. M., after a copious luncheon consisting of beer, sauerkraut, etc. Shock, pain and collapse were most pronounced, so I am informed, which continued until I saw the patient at 11 A. M. I found the patient pulseless, cold, with temperature of 97°. I declined to operate and she was dead in an hour. While autopsy was not permitted, there is little doubt as to the diagnosis.

In subacute perforation spontaneous recovery may occasionally result. Here rupture takes place suddenly, perhaps without warning, as in the acute variety, but at a time when the stomach is empty. Therefore. little or no escape of gastric contents occurs and spontaneous recovery is possible. I have seen a well marked instance during the past year.

A woman, aged about 50 years, was sweeping in her kitchen before breakfast at 6 A. M. Suddenly she was seized with pain, shock and all the symptoms of perforation. When I was asked to see the case in consultation, about a fortnight later, she had a subphrenic abscess, which I take it, confirms the diangosis of perforation. She recovered.

While admitting the possibility of spontaneous recovery in subacute perforation no one should feel justified in accepting the small chance offered by nature. Be it remembered here, and I wish to emphasize what usually is not borne in mind, that perforations may be multiple, indeed are, in 20 per cent. of all cases. It is unlikely that two or more openings will spontaneously heal, as enough leakage will occur to make peritonitis almost certain.

In chronic perforation either the result of ulcer or of malignant disease, adhesion may have formed, the general cavity of the peritoneum be shut off and speedy death thus averted. To conclude we may say that the hazard of delay is great and unwarrantable. Operative statistics are improving daily and if general practitioners will have surgeons associated with them in threatened or suspected cases of perforation they will still further improve.

HEMORRHAGE.—He would be a rash surgeon indeed who advocated laparotomy in every case of hematemesis caused by gastric ulcer. The first hemorrhage should always, in my judgement be treated by the usual medical means. In addition, high enemata of hot water (Temp. 120°) as advocated by Tripier should be employed. Hot water of course acts reflexly. In addition to arresting hemorrhage from the stomach it also, in the best possible way, combats shock and makes good the loss of blood already sustained. If a second severe hemmorhage occurs the wise and conservative surgeon will still decline to operate until shock has subsided. Too great delay, however, means a third, perhaps a fourth hemorrhage which may be fatal. A careful investigation of every published case in 1900 convinced the writer of the danger of too great delay and caused him to advocate operative interference in acute hemorrhage. Hemorrhage may be likened to appendicitis. The first attack may be recovered from and a second never experienced; but once the recurring nature of the disease is established it is only a question of time when a fatal attack may result. Operation in both cases is conservative after the second *severe* attack. Perigastric adhesions, stricture, dilation, hour-glass stomach are all mechanical troubles and can only be relieved by operation. It is no longer a possible question of chemics but of physics, and it is, therefore, manifestly improper to continue dosing such patients until the propitious time for surgical intervention has passed. The keynote in such cases should be gastric drainage. That is to say, the stomach should be rapidly emptied by means of a gastroenterostomy. It is not germane to the discussion

to enter into the question of the technique of the operation further than to say that posterior gastroenterostomy by direct suture seems to meet the indications best and is preferred by the great majority of operators. It is somewhat more difficult, requires an additional ten to fifteen minutes over the anterior operation and, therefore, presupposes no especial demand for haste. In cases in which speed is essential the anterior operation by means of one of the various mechanical devices, notably the McGraw elastic ligature or the Murphy button should be employed. The writer agrees with Mayo that the disfavor into which the anterior operation fell was oftentimes, perhaps usually, due to faulty technique. If the anastomosis is made at the most dependent portion of the stomach, the vicious circle and other untoward complications will generally be avoided.

The very fact that so many expedients for escaping the vicious circle have been proposed is the best evidence one can offer that *none* are perfectly satisfactory. Moreover, hemorrhage, perforation, subphrenic abcess and carcinomatous implantation have each been known to follow apparently successful gastroenterostomies. It does not remove the lesion, but cures the ulcer by rest, short circuiting as it does the food which passes from the stomach to the jejunum and not through the inflamed and ulcerated pylorus. It is a very satisfactory operation in the main, applicable to a large number of cases, and can be done with a mortality of 5 per cent. Its limitations, however, are definite and should be recognized; otherwise its indiscriminate employment may bring an excellent precedure into disrepute.

Pyloroplasty and pylorodiosis have each had their day and now enjoy but a limited popularity, as the latter has been shown to be always futile, the former generally so (Mayo had relapses in 70 per cent. of his cases, due doubtless to the fact that the pyloric opening is left on a higher level than the rest of the cavity and the weakened gastric walls cannot, so to speak, lift the food over this outlet). Traumatic perforation is more than a possibility. It is questionable if pyloroplasty should ever be done in open ulcer.

FINNEY'S OPERATION.—Though called by its author pyloroplasty, the profession has pretty generally given it another name, gastroduodenostomy. The opening made is larger, on a lower level than in the Heineke-Mikulicz procedure, and, therefore, less likely to be followed by a recurrence of symptoms. But recurrences are not infrequent at best and open ulcers are likely to remain uncured as the constant irritation of the food prevents healing.

EXCISION.—Excision of the ulcer would seem, theoretically, to best meet the indications in those cases in which the lesion is solitary, situated on the anterior gastric wall and reasonably free from hampering adhesions. In practice ulcers are so frequently multiple, situated posteriorly and associated with dense adhesions that simple excision of the ulcer is impracticable. It has failed to command the confidence of surgeons in general and must, for the reasons given, continue to be a more or less unsatisfactory procedure. Pylorectomy, partial gastrectomy or excision of the ulcer-bearing area, while necessarily a more formidable operative measure than any of the preceding ones, and, therefore, at present of limited application, has the following advantages over less radical operations: (1) It removes the lesion or lesions and in this way prevents future hemorrhage, perforation, subphrenic abscess and carcinomatous implantation upon the base of the ulcer or resulting cicatrix. In 159 cases of carcinoma of the stomach operated upon by the Mayo brothers there was a history of preceding gastric ulcer, at some time of the patient's life, in 60 per cent. of the number. These cases were carefully examined by Graham.

When we reflect that the topography of carcinoma and ulcer is practically the same, 80 percent. of each at or near the pylorus, the inference is a fair one that many ulcers undergo malignant change sooner or later. Chronic ulcers in men after forty are particularly prone to malignant change and should be met by pylorectomy.

(2) Ulcers are so frequently multiple, one on the anterior wall being usually accompanied by another directly opposite on the posterior wall, that pylorectomy seemingly best meets the indications.

(3) Gastric ulcers are frequently associated with one or more ulcers in the first two inches of the duodenum. These latter are particularly liable to perforation and can be removed along with the pyloric end of the stomach without adding to the mortality.

(4) Various mechanical difficulties following and resulting from previous ulceration such as stricture, hour-glass stomach, etc., etc., can only be prevented by excision of the ulcer-bearing area. The mortality should not exceed 10 percent. and, in the cases already operated upon, has not reached that figure. This is less than one-half the mortality usually given by internists when medical means only are employed. In conclusion, I would emphasize the fact that when operation is decided upon, and it should be generally done in chronic ulcers resisting medical and dietetic treatment for four weeks, the abdomen should be opened with the expectation of doing that operation, which it

seems will best fulfill the indications with the least mortality. Gastro-enterostomy is, and generally should be, chosen and will usually give excellent results. When from chronicity carcinomatous implantation is either expected or feared; when the ulcers are any of them threatening to perforate; or when adhesions, disabling in character, are likely to form as the result of cicatrization, pylorectomy is truly the conservative course. We must again insist that medical means be first given a fair trial, but according to Leube, the most optimistic of physicians, such treatment should not be persisted in until the patients are too reduced for surgical intervention. The best results will necessarily accrue from a hearty cooperation on the part of the physicians and surgeons of hospitals where complications can be promptly recognized and met.

DISCUSSION.

DR. ALFRED STENGEL: I concur in the statement of Dr. Howard that we may distinguish an acute and a chronic form of gastric ulcer, but in so dividing the cases it must be recognized that the distinction is clinical rather than pathologic. Chronic ulcers of the stomach have impressed me as being simply of the type of indolent ulcers elsewhere. Their pathologic basis is the same as that of the acute, and the sluggish course is attributable to local or systemic conditions. Much confusion regarding statistics, diagnosis and treatment could be avoided if we distinguished from these ulcers, acute or chronic, certain conditions that resemble them slightly, especially erosions, hemorrhagic or simple, and post-mortem digestion of the stomach. One instance reported in the medical literature of supposed death from perforation of a gastric ulcer in a child came under my notice, and I saw the specimens which proved that it was a case of post mortem digestion. I have seen a number of cases of hemorrhagic erosion such as those Dr. Howard has referred to. In my experience these have been most common in cases of passive congestion from mitral heart disease and other causes. Such cases must of course be excluded in any statistical tabulation, but some writers incline to extend the limits of what is termed ulcer to include such diverse conditions as these. No doubt statistics would be more reliable if they were all based upon pathologic studies with a careful elimination of the conditions I have alluded to, but clinical experience is of some value and is particularly helpful to the clinician who is more concerned with the cases that manifest symptoms than with those that are latent and are undiscovered during life. I have looked over my own records at the University Hospital and the Pennsylvania Hospital and have found that in approximately 2,000 cases at the University Hospital, 10 were diagnosed as ulcer of the stomach, 2 additional cases being omitted though hematemesis was the symptom that brought the patient to the Hospital. One of the 2 was subsequently operated upon elsewhere for supposed ulcer of the stomach, but no ulcer was found. At the Pennsylvania Hospital among 375 cases there was one case of gastric ulcer and one doubtful case.

The diagnosis is of particular interest to the clinician for the treatment is quite clear and every clinician would agree with Dr. Henry's estimate of the

proportionate medical and surgical interest in this condition. With regard to diagnosis, the condition must be approached from the point of view of the prominent symptoms. Gastric ulcer manifests itself by very different preliminary symptoms in different cases. Hemorrhage, pain, dyspeptic symptoms and vomiting are among the more conspicuous indications. With regard to hemorrhage, I think the tendency of the profession is to look upon this as an almost certain sign of gastric ulcer, providing the hemorrhage is a large one and the blood is fresh and not of the coffee-ground character seen in carcinoma. Physicians recognize that cirrhosis of the liver, portal thrombosis, and other conditions may occasion hematemesis, but in practice too frequently forget this. Among other conditions that should be remembered in this connection is splenic anemia. The frequency of gastric hemorrhage in this disease has been referred to by every writer on the subject. There are, however, I think conditions in which large hemorrhages from the stomach occur and in which there is neither gastric ulcer nor any of the other recognized causes. I suspect there may be conditions of the gastric mucous membrane in which it readily bleeds on slight irritation. A case in point may prove instructive. A young woman was admitted to my wards at the Pennsylvania Hospital who had had, at rather long intervals, four large hemorrhages from the stomach. Finally she was operated on at the University Hospital and a large incision made into the stomach through which the mucous membrane was exposed as thoroughly as was possible. No ulcer was discovered, though of course one may have been present and have escaped detection. The point to which I wish to refer, however, is that at various places, as the mucous membrane was exposed, blood streamed so freely as to account for the large losses sustained in her attacks. I have used the word "streamed" because it would be understating the conditions to say there was an oozing from the mucous membrane. The merest touch of a compress of absorbent cotton produced really violent hemorrhage. The conditions here certainly were very different from those seen in the normal mucous membrane. Further, with regard to this question of hemorrhage as a symptom of ulcer, I wish to refer to 2 cases under my care at the University Hospital. The first of these was an hysterical patient who had submitted herself to all kinds of operations and who came to us requesting operation for gastric ulcer. My suspicions were aroused and I could not find any indications of ulcer. On this ground, though I could not discover the source of the hemorrhage or how it was produced, I concluded the condition was feigned or neurotic and refused to advise operation. Subsequently she was operated elsewhere and I was told that a careful search of the mucous membrane did not reveal any ulcer. The second case was of similar character. I cite all of these instances because it is my experience that medical men look upon hematemesis as definitive proof that there is an ulcer. In all cases I think the diagnosis of ulcer of the stomach must be made by exclusion. The existence of the cardinal symptoms, hemorrhage, pain and dyspeptic disturbances, may in certain cases make the diagnosis positive at the first examination, but when any of these is ill-defined or atypical, the diagnosis cannot be reached without very careful consideration of all other possible explanations of the symptoms. The statement has been made that in 60% of cases of gastric carcinoma there is a preliminary history of gastric ulcer. To intimate that such a percentage of cases of gastric carcinoma begin as gastric ulcer is, to say the least, absurd. In a small series of

selected cases, this might perhaps be true, but in general a tendency to exaggerate the frequency of carcinomatous transformations of gastric ulcers has recently become more or less fashionable. With regard to the actual percentage of such transformations, even the pathologist may be in error, for I recall an instance of a flat carcinoma of the stomach which was thought to have begun as an ulcer, but it was subsequently discovered that the central ulceration was simply a terminal ulceration of a lesion that was in the beginning a carcinoma. The association of gastric ulcer with tuberculosis and nephritis discovered by Dr. Francine may perhaps have been due to the class of cases studied by him at Blockley. The comparatively advanced age of his patients shows that he was not dealing with many of the acute variety and his statistics hardly represent the entire field. In cases of chronic ulceration nephritis and tuberculosis may readily occur as secondary conditions. Ulcerations of the stomach and bowels in association with nephritis were described by Dickinson some years ago and I believe they are not infrequent. The association of anemia or chlorosis with ulcer is an interesting question. It is well known that the blood during regeneration after hemorrhages has practically the appearances of chlorotic blood. I have no doubt that one of my cases, after a large hemorrhage, would have been called a case of chlorosis by any one who had not obtained a full history. I suspect that in some cases of the supposed association the anemia is due to occult hemorrhages. This was certainly the case in one of my patients, an oldish woman who was subsequently cured by an operation performed by Dr. Edward Martin. Indeed, I am so convinced that the chloroanemic condition in these cases is due to repeated small hemorrhages that I am inclined to suspect this cause as operative in what we regard as pure chlorosis. This question needs investigation.

DR. JOHN H. GIBBON: This subject has interested me, not so much on account of the diagnosis and treatment of acute gastric ulcer, but more because of the complications of chronic ulceration which I have had to treat during the past 2 or 3 years. I feel that the attitude of surgeons regarding gastric ulcer has hardly been fairly presented by some of the medical speakers. Surgeons are not clamoring to operate upon acute gastric ulcers, but they do feel that when an ulcer fails to respond to medical treatment the patient's best chance of recovery and avoidance of serious complications lies in surgical intervention. If gastric ulcers were diagnosticated and treated on the lines laid down to-night there would be little work for the surgeons to do. No doubt the small proportion of recurrence of symptoms after operations for perforated gastric ulcer in which the ulcer has only been inverted, result from the prolonged rectal feeding, which is carried out by most surgeons after the operation. I agree with Dr. Stengel that patients with acute gastric ulcer should be fed by the bowel for 3 weeks. I have operated upon 6 perforated gastric ulcers in the past 2 years and 2 of these patients who recovered were fed entirely by the bowel for 18 days, with the exception of a small amount of water, and in one instance of 2 sticks of peppermint candy which the patient ate surreptitiously without harm. Two of the other 4 patients died soon after the operation from peritonitis, the third some days after operation from delirium tremens, and a fourth about 3 weeks after operation of pelvic abscess due to faulty drainage. The enema which I have used with most satisfaction is one of malted milk, 4 ounces given every 4 hours. Dr. Stengel

referred to two cases of severe gastric hemorrhage. I think it is very difficult to say that in the first case there was no ulcer in the stomach because none could be seen through the incision. It is practically impossible to examine the entire mucous lining of the stomach, especially that portion of it on which ulcers are most frequent, unless an extensive incision is made. The bleeding itself is oftentimes sufficient to obscure the field. It may of course be said there is no chronic ulcer because of the absence of adhesions and induration. I think even this may be open to question. With regard to the second case referred to by Dr. Stengel, it would be interesting to know the outcome of the operation which was done after the patient left his hands. It is possible of course that the patient suffered from gastric ulcer in addition to the hysteria. I wish to say a word in relation to the prognostic value of tumor. So often in the presence of gastric symptoms and a palpable tumor there is a tendency to look upon the condition as a malignant one and to consider operation unnecessary. This attitude is an incorrect one for a surgeon or medical man to take. In August, 1903, I operated upon a woman in whom there was a distinct palpable tumor in the pyloric region with symptoms of pyloric obstruction. From the history I believed the case to be one of gastric ulcer. When I opened the abdomen, however, and encountered a large tumor involving the pylorus more or less bound down and with enlarged glands, I changed my diagnosis to one of malignancy and did a gastroenterostomy. If the patient improved I hoped later to do a partial gastrectomy. Her improvement after the operation was gradual and continuous; the mass entirely disappeared and the patient is living today and perfectly well. This was undoubtedly a case of gastric ulcer with extensive induration. This was one of those cases to which Dr. Rodman referred, in which a differential diagnosis between malignancy and gastric ulcer with adhesions is difficult. Wherever this question arises an exploratory operation should be done.

DR. H. E. WETHERILL: In connection with reading Dr. Kelly's article on the Piezometer, in *The Johns Hopkins Bulletin*, September, 1904, p. 293, I found that Dr. Emil Schnoll speaks of the Algesimeter of Boas. (*Diag. u Ther. der Magenkrank.*, Leipzig, 1894, p. 75.) These instruments are useful in making a differential diagnosis between gastric ulcer and gastric carcinoma in some cases, and will localize the pain by the decrease of its threshold, and when not apparently harmful, are serviceable. In Tyson's Medical Conference during the session of 1894–5 I demonstrated the use of Prof. Cattell's, (of Columbia), algometer for this purpose. Dr. H. Kelly uses his instrument more especially for measuring the rigidity of the abdominal wall in appendicitis. My instrument in addition measures edema.

DR. LAMBERT OTT: There seems to be a predisposition in some individuals to the recurrence of gastric ulcer. At the present time I am treating a patient for the third attack. The two previous attacks occurred at intervals of 5 years and were attended with severe hemorrhages. One of the essayists tonight recommended the administration of bismuth subnitrate in a mucilaginous mixture, which I consider a mistake, as the powder is rolled into balls and thereby fails of its purpose: being principally to spread a coating over the stomach walls and especially over the surface of the ulcer. This fact I discovered while treating my own child for a severe attack of gastrointestinal catarrh. Just as soon as I discontinued the mucilaginous mixture and gave the simple aqueous solution the benefit to the patient was evident and the balling of the bismuth ceased. A

potent remedy of which too little was said is the silver salt. In some recent cases in which I failed to obtain results from the administration of bismuth I changed the remedy to silver nitrate. Of a mixture containing 5 grains to 6 ounces of distilled water I gave one tablespoonful in a wineglass full of water one-half hour before meals. The effect was striking and after 2 bottles had been consumed the patients were able to take solid food. I have never seen argyria follow. Raw milk and animal broths is the basis of all dietary. Boiled milk is to be avoided. In addition to the above medication, my plan is to enforce 3 weeks of continuous rest in bed and 3 weeks more of partial rest associated with a daily outing in the fresh air and sunshine. Little is to be gained by prolonged recumbency.

DR. JOSEPH SAILER: It should not be forgotten that statistics derived from autopsy records may be fallacious, particularly if the autopsies have been performed by many different men according to various methods. It may sometimes occur that the signs of a previously existing gastric ulcer, or even a small actual gastric ulcer, are overlooked. Small scars are not readily detected upon the rugous mucous membrane of a contracted stomach. Sometimes, indeed, when the autopsy has been otherwise satisfactory the stomach has not been opened at all. Therefore, it may be that the percentages obtained from autopsy records are smaller than they should be. A study of the literature of the treatment of gastric ulcer indicates that there are many different methods employed by different authorities, some feeding by the mouth from the very beginning; others for long periods only by the rectum, or employing almost complete starvation; and yet if we can trust their figures, the results are about equally good. Personally, I prefer rectal feeding for a considerable period of time. After commencing alimentation by the mouth I find a most useful article of diet is olive oil or some other bland oil, which may be given without the slightest danger of injury. Among other remedies, I have employed gelatin and calcium chlorid by the mouth, possibly with advantage and certainly without the least evidence of ill effect. The theoretic objections to silver nitrate expressed by Dr. Henry must have occurred to many of us. As a substitute I have sometimes employed dilute solutions or protargol introduced and withdrawn through the stomach tube, lavage being employed before and after. This will always produce a sense of alleviation in the stomach, and I have seen no injurious effects. The time at which the patient may be regarded as having recovered is important. It has been my custom to consider the entire absence of symptoms for a considerable period of time (2 or 3 weeks) while the patient is on liberal diet, and also the entire disappearance of blood in the stools during this period, as an evidence that the patient may, if strong enough, return to his usual occupation, of course remaining under occasional supervision.

DR. B. FRANKLIN ROYER: I would like to ask, whether, the vicious circle having been established, the operation of enteroanastomosis in addition to the gastroenterostomy is preferred by the surgeons of today?

DR. RODMAN: Mayo, in 157 cases of carcinoma found a good history of gastric ulcer in 60%. The inference is that there must have been carcinomatous implantation upon the ulcer. The actual number of carcinomata resulting from the cicatrices of ulcers will always be in doubt. Personally I think that 10% or 15% is not too high an estimate. The best way of overcoming the vicious circle is to do a gastroenterostomy supplementing this by enteroanastomosis either by direct suture or the Murphy button.

The Limitations and Possibilities of Electricity in the Treatment of Diseases of Women.

BY BARTON COOKE HIRST, M. D.

[Read January 25.]

The title of this small contribution to the transactions of the Society is, I fear, too pretentious. It implies a study of X-rays, the ultraviolet rays and high frequency currents with which I have no personal experience and which will be employed only by specialists in electrotherapeutics.

My object is simply to call attention to the use of galvanism and faradism in a few of the diseases of women in which more can be accomplished by this means than by any other treatment.

It is not strange that the present day gynecologist looks askance at electricity. Those of us who have been long enough in practice remember only too well the disappointment which followed a trial of Apostoli's methods, the failure of attempts to cure all sorts of pelvic inflammatory conditions, and the futile effort to destroy the embryo in extrauterine pregnancy by electrical currents. But the swing of the pendulum, as often happens, has gone a little too far. Many of us are neglecting, I think, a most useful treatment in one or two affections which are amenable to nothing else.

In the excellent monograph on fibromyomata by Bishop, published two or three years ago, there is a fair and convincing section on electricity as a hemostatic agent in the treatment of fibroids in which operation is contraindicated, or is not really necessary. It is all the more convincing because Bishop is an enthusiastic advocate of operative treatment, and was one of the first to urge an extension of the indications for it. I had tried electricity myself twelve or fifteen years before, and was one of a committee appointed by this Society, years ago, to investigate the results obtained. I was disappointed in it and gave it up.

After reading Bishop's book, it appeared to me that such an uncompromising attitude was prejudiced, and as other cases than fibroids occasionally applied for treatment, in which electrical stimulation was obviously the only means of relief, I installed in my office again a full electrical equipment, including electrodes that could be sterilized as easily as any other surgical instrument. During the last two years and a half, this equipment has demonstrated its utility in the following limited number of cases: As a hemostatic in bleeding

fibroids; as a stimulant in amenorrhea and sterility the result of imperfect development or atrophy of the uterus and to restore tone to a sphincter ani that has been severed, has been unrepaired for many years, and though successfully repaired, remains paretic.

I am not yet prepared to admit that every fibroid of the uterus must be removed. In 195 such cases subjected to surgical treatment under my care, there were only seven in which it could be positively stated that death must have ensued without operation; three sarcomatous and four necrotic degenerations. In addition there was one case of adenocarcinoma of the endometrium, but the association was purely accidental, and there was no causative relation between the two. There were naturally many other complications in my cases, more or less serious, but in none except those mentioned could it be truthfully stated that the issue would inevitably have been fatal without surgical intervention. From personal experience, therefore, and from a careful study of others' records, it appears that the conscientious surgeon must frequently see cases of comparatively small fibroids, with no other symptom than metrorrhagia, in which an operation is not required. In these cases, if there is no continued growth, no sign of malignancy, no complication such as cystic degeneration or inflammation of the appendages, I doubt if there is a more reliable hemostatic than repeated applications of a galvanic current, forty to sixty milliamperes, with the positive pole in the uterus. About twenty applications are needed, for fifteen to twenty minutes, every other day. As an illustrative case:

Mrs. L., aged 39 years, had had 3 severe hemorrhages several months apart in the course of a year The last one had been so serious that she was exceedingly anemic Her hemoglobin percentage was in the neighborhood of ten and her heart was feeble and irregular. A gynecologist, called in at this time, urged an immediate operation, stating that unless it was performed by a certain date (on which he was to sail for Europe) she could not survive the summer. This advice was rejected by the family physician, the patient and her family, who felt that an abdominal hysterectomy, in view of the patient's condition, would pretty certainly prove fatal. The following autumn I began treatment with electricity after finding a fibroid no larger than an orange, with no complications and no other symptoms except the metrorrhagia. Twenty-one treatments were given. The patient has had no hemorrhages in the last 15 months and feels perfectly well. It is unlikely that her small fibroid will cause any more trouble. If an operation is indicated at any time in the future she will return to me for it.

For an atrophied or ill developed uterus, I can conceive of no other treatment so rational to stimulate and develop the pelvic organs

as faradism and the negative pole of a galvanic current in the uterine cavity. Two cases may serve to illustrate the possibilities of this treatment.

Mrs. W., married 17 months, has not been pregnant; has not menstruated at all for a year. Examination showed ill developed or atrophied uterus. After 4 treatments a menstrual flow appeared, profuse and lasting 10 days. Conception occurred shortly afterward and she has recently been delivered of a healthy child at term.

Mrs. B. has had 2 children. After the second, 4 years ago, she developed an extreme degree of lactation atrophy. When the baby was weaned menstruation returned, but was scanty, not lasting a day. Intense headaches appeared with the periods and grew worse as the menstrual flow diminished in amount and duration. Medicinal and hygienic treatment was recommended but failed. After 6 weeks' treatment with electricity, a flow was established, normal in quantity and duration, the headaches were relieved, the general health improved and the patient conceived again 6 months later. She is now 5 months pregnant.

There is no necessity for insisting upon electricity as the only means to strengthen a weak sphincter muscle. There is no other treatment to recommend. If the operation for the repair of a complete laceration of the perineum is properly performed in the first place, there is very seldom need for further treatment of any kind. Of late years I have operated on twelve to twenty such cases annually; in half the cases after some one else had failed; and in only two instances has electrical stimulation been indicated: in one woman operated on three times before without success, in a period of fourteen years, and in another with two unsuccessful attempts in ten years. In both cases the contractile power of the sphincter was restored.

There is one other indication for electrical stimulation of the uterus, I believe, in the dysmenorrhea of young women with ill developed uteri; in which dilation and currettage have failed to give relief. For the last eighteen months I have used Schatz's metranoicter in such cases in addition to forced dilation with branched dilators, and my proportion of failures is less than it was. In my last thirty cases there are only two symptomatic failures, both young women of a neurotic type with ill developed wombs. I believe that electrical stimulation might effect a cure in these women, but there are two objections to its use: the propriety of any local treatment in young unmarried girls is questionable and there is danger of breeding sexual hypochondriasis in a neurotic woman by long continued local treatment. In the very few cases in which such treatment might be justifiable, it would be more likely to afford relief, I think, than any other remedy. The

typical case for this treatment would be the married woman with dysmenorrhea and sterility, without tubal or appendiceal disease, who is not relieved by dilation with branched dilators and the metranoicter. Since using the latter instrument, however, I have not yet had a failure in such cases.

The Pasteur Treatment for Rabies Administered at the Patient's Home.

BY MYER SOLIS-COHEN, A.B., M.D.

[Read February 22..]

The majority of physicians are familiar with the Pasteur treatment for rabies, as conducted by the Pasteur Institutes; but not many are aware that this treatment may be carried out by any physician at the patient's home. Several months ago I administered the Pasteur treatment at their homes to two persons who had been bitten by a rabid dog.

In a series of communications* to the French Academy made in 1884, 1885 and 1886, Pasteur announced his discoveries as to the nature of rabies and described his method of treatment.

The virus is found principally in the saliva and in the central nervous system of rabid animals. Infection occurs ordinarily through the saliva, which enters the wound made by the animal's teeth. Bites on exposed parts of the body, therefore, are more dangerous than bites through clothing, as the saliva may be wiped off by the clothing. The virus travels along the nerve trunks to the spinal cord, and thence to the medulla and brain. Consequently, the most dangerous wounds are those in parts richly supplied with nerves, namely, the head and face, and next the hands. Between the bite and the appearance of the first symptoms, a period of incubation intervenes, its length depending upon the amount and strength of the virus inoculated, as well as upon the location of the bite. In man it averages forty days.

Animals that have died of rabies show destructive changes in the peripheral ganglia of the cerebrospinal and of the sympathetic nervous systems, these changes being especially marked in the plexiform ganglion of the pneumogastric nerve and in the Gasserian ganglion. The normal histologic picture shows each nerve cell enclosed in a capsule composed of a single layer of endothelial cells. But in animals

*Pasteur. "Le Traitement de la Rage." Paris, 1886.

that have died of rabies a proliferation of these endothelial cells is seen, with destruction of the normal ganglion cell, which is replaced by a collection of round cells. It is by observing these changes in an animal that has died of the disease that a positive diagnosis of rabies can be made. These changes, however, are of slow development, and in order to permit them to occur, the animal should be allowed to die from the disease. It should not be killed, as in that case the changes may not be found.

Pasteur inoculated rabbits with the virus of rabies of the streets, which ordinarily will produce symptoms in these animals in from three to four weeks. He was able to increase the virulence and shorten the period of incubation by inoculating the rabbits in series, one from the other. After a hundred such passages, the rabbits died within six or seven days after inoculation. No further increase of virulence could be obtained. The virus thus obtained is termed "fixed" and is used in preparing the vaccine. On the other hand, the virus may be attenuated and even destroyed by exposure to light or by drying. This latter method is used in preparing the vaccine for the Pasteur treatment. Upon the death of a rabbit inoculated with the so-called "fixed "virus, the spinal cord is removed without being contaminated, cut into three equal parts and suspended by silk threads in a large bottle which has an opening near the bottom. Both openings are plugged with cotton, to allow the free passage of air, and on the bottom of the bottle is spread a layer of potassium hydroxid. When kept in the dark under these conditions at a temperature maintained at 23° C., the cords gradually lose their virulence, losing it entirely in about fifteen days, and retaining but a very slight amount when kept for fourteen days.

The Pasteur treatment is preventive, not curative. Instituted as soon as possible after inoculation, it produces an active immunity that antagonizes the morbid process during the period of incubation. Thus the development of symptoms is prevented. After symptoms have appeared, treatment is of little avail.

The treatment takes from fifteen to twenty-one days, depending upon the richness of the nerve supply of the part bitten. Beginning with the weakest virus—an emulsion of a cord that has been dried for fourteen days, daily inoculations are made, under aseptic precautions, with cords of increasing virulence. In the ordinary course of eighteen injections the following doses are usually given:

First day, 3 cc. of 14 days cord, 3 cc. of 13 days cord; second day,

3 cc. of 12 days cord, 3 cc. of 11 days cord; third day, 3 cc. of 10 days cord, 3 cc. of 9 days cord; fourth day, 3 cc. of 8 days cord, 3 cc. of 7 days cord; fifth day, 2 cc. of 6 days cord; sixth day, 2 cc. of 5 days cord; seventh day, 2 cc. of 5 days cord; eighth day, 2 cc. of 4 days cord; ninth day, 1 cc. of 3 days cord; tenth day, 2 cc. of 5 days cord; eleventh day, 2 cc. of 5 days cord; twelfth day, 2 cc. of 4 days cord; thirteenth day, 2 cc. of 4 days cord; fourteenth day, 2 cc. of 3 days cord; fifteenth day, 2 cc. of 3 days cord; sixteenth day, 2 cc. of 5 days cord; seventeenth day, 2 cc. of 4 days cord; eighteenth day, 2 cc. of 3 days cord.

During the course of the treatment the patient's bowels should be kept freely open and alcoholic excesses should be avoided.

The injections, as a rule, produce no constitutional symptoms. Sometimes the patient complains of drowsiness, or, on the other hand, of nervousness and disturbed sleep. The local symptoms vary in different individuals, being marked in very fat or alcoholic persons.

Should persistent or marked inflammation occur at the site of puncture, it should be treated as any ordinary cellulitis—with an ice-bag, antiseptic dressing, etc.* If no symptoms have developed two weeks after the cessation of all treatment, the patient is considered out of danger.

The Department of Health of the city of New York has a Pasteur Institute which possesses the confidence of the medical profession. In addition to administering the virus at the institute in New York City, this department undertakes the Pasteur treatment at a distance, mailing the virus each day by special delivery. Upon its arrival the virus should be put on ice until used, and should be injected as soon after its arrival as practicable.

The New York Health Department is guided in arranging the course of treatment for the individual case by the following information, which is required to be given as soon as possible: first, Name and age of patient; second, location of bite, date and severity of bite with its treatment; third, any information bearing on the diagnosis of the animal inflicting the bite; fourth, a brief report on the patient's condition two weeks after the end of treatment.

On November 19, 1904, a man, aged 61 years, and his son, aged 15 years, were bitten by a dog which presented the clinical symptoms, and later the pathologic findings, of rabies. Dr. Edward Martin, Director of the Department of

*Personal communications from Dr. D. W. Poor of the Department of Health of the city of New York.

Public Health and Charities of the City of Philadelphia, through his Chief Medical Inspector, Dr. A. A. Cairns, made arrangements with the Department of Health of New York City to have them mail the Pasteur treatment for both patients by special delivery. As Assistant Medical Inspector, I was asked to take charge of the treatment. Each day's treatment was mailed to me by Dr. D. W. Poor, of the New York Health Department, and was received sometimes on the night of the day it was sent, but more often on the day following. When the virus arrived it was put on ice and administered as soon as practicable. I made the injections in the subcutaneous tissue of the abdomen at some distance from the point of the preceding inoculation. The skin was washed with soap and water and then with alcohol or with a 1 to 500 solution of formalin. This last washing was wrong, as no germicide should be used unless subsequently removed with sterile water. I disinfected my hands at first by scrubbing them with soap, water and a brush, and then immersing them in a 1 to 500 formalin solution; but later I put on rubber gloves, which I soaked while on my hands in the formalin solution. I wore the gloves as a protection to myself, although Dr. Poor regards such precaution as unnecessary. I employed a 10 cc. metal antitoxin syringe, which I took apart, boiled and then cooled before using. The point of puncture was sealed with collodion or with compound tincture of benzoin.

The treatment caused neither constitutional disturbance nor local reaction, except on one or two occasions which will be described later in detail. The patients were not confined to the house. The man, a night watchman, attended to his duties throughout the whole course of treatment. The boy went out and could have attended school had his parents permitted. Inasmuch as the patients developed no symptom of rabies during the course of the treatment or in the two weeks following, they were regarded as free from the disease.

I now shall describe the cases in greater detail.

F. E. F., aged 61 years, married, a night watchman, was bitten by a dog on November 19, 1904. He had used alcohol to excess; and at the time I examined him showed general arteriosclerosis, cardiac dilation and tuberculous consolidation of the right lung.

The man had been bitten slightly on both thumbs. Blood could be squeezed from the right thumb which did not bleed much. The left thumb bled more freely. Two hours after the bite the wounds were cauterised with the silver nitrate stick. They received no other treatment. The dog was taken to the Veterinary Hospital of the University of Pennsylvania and allowed to die. The plexiform ganglia and the medulla were examined on November 26th, in the Pepper Clinical Laboratory, by the pathologist of the State Live Stock Sanitary Board of Pennsylvania, and were found to be the seat of the changes described as diagnostic of rabies.*

I began treatment on November 23d, without waiting for the report from the laboratory. The patient at that time complained of a numb, chilly feeling and of a cramp in his left hand and arm which had been present since the bite. He had felt worried, nervous and depressed, and had not been sleeping well. There was a superficial cut ½ in. long on the inner aspect of the dorsum of the

*If the head of an animal suspected of rabies be sent to the State Live Stock Sanitary Board of Pennsylvania, Pepper Clinical Laboratory, Thirty-fifth and Spruce Streets, Philadelphia, this examination will be made free of charge.

left thumb, over the second joint, and there was a scratch on the last phalanx of the right thumb.

The treatment was as follows:

First injection, November 23d, 2 doses of 3 cc. each of 13 days cord; second injection, November 24th, 2 doses of 3 cc. each of 13 days cord; third injection, November 26th, 2 doses of 2½ cc. each of 10 and 9 days cord; fourth injection, November 27th, 2 doses of 3 cc. each of 8 and 7 days cord; fifth injection, November 29th, 1 dose of 3 cc. of 5 days cord; sixth injection, November 30th, 1 dose of 2½ cc. of 4 days cord; seventh injection, December 1st, 1 dose of 2 cc. of 3 days cord; eighth injection, December 2d, 1 dose of 2 cc. of 3 days cord; ninth injection, December 3d, 1 dose of 2½ cc. of 4 days cord; tenth injection, December 4th, 1 dose of 2½ cc. of 3 days cord; eleventh injection, December 6th, 1 dose of 2½ cc. of 4 days cord; twelfth injection, December 7th, 1 dose of 2½ cc. of 3 days cord; thirteenth injection, December 9th. 1 dose of 2½ cc. of 3 days cord; fourteenth injection, December 10th, 1 dose of 2½ cc. of 5 days cord; fifteenth injection, December 11th, 1 dose of 2½ cc. of 4 days cord; December 12th, missed, 1 dose of 2½ cc. of 4 days cord; sixteenth injection, December 13th, 1 dose of 2 cc. of 3 days cord; seventeenth injection, December 14th, 1 dose of 2½ cc. of 5 days cord.

The injections caused no pain at the time they were made. On several occasions, however, pain lasting several minutes developed at the seat of puncture shortly after the injection. On November 24th, the second day of treatment, about 2½ hours after the injections of 3 cc. each of 13 days cord, severe pain developed at the sites of the injections, which were at distant points on the abdomen. The pain was burning in character and was extremely severe. In the words of the patient: "It knocked him out." He was doubled up and could not straighten himself. The acute pain lasted 3 hours, but a less severe pain, associated with soreness and tenderness persisted for some time after. There was little constitutional disturbance at this time. Seven hours after the injection the patient felt chilly for 4 hours, and about 6 hours later he again felt chilly for a short time. For a few days, beginning December 1st, there was an intense itching at the site of the injections.

A diffuse redness often appeared immediately or shortly after the injection at the point of inoculation, frequently extending downward and to each side for a distance of 2 inches. This persisted for varying periods of time, from a few hours to a day or two. After the first week of the treatment the patient felt badly and depressed and complained of a "dry chilly feeling." His temperature was subnormal the greater part of the time.

On November 25th, it was 98.1°; on November 26th, 97.8°; on November 27th, 97.7°; on November 30th, 99.1°; on December 2d, 98.3°; on December 6th, 98.3°; and on December 14th, it was 96.8°.

The patient felt well for the 2 weeks following the treatment and, as late as February 21st, had experienced no further inconvenience from the bite or the treatment.

B. R. F., the above patient's 15-year-old son, was bitten by the same dog on the same day as his father. He had had several attacks of inflammatory rheumatism which had left him with an enormously hypertrophied heart, the seat both of obstruction and of insufficiency at both the mitral and the aortic orifices.

He was bitten in the right corner of his mouth on the margin, and just outside of the margin, of the upper lip. The lip swelled but did not bleed. The boy was bitten also on the dorsum of the right wrist and of the first joint and second phalanx of the right thumb, and he was scratched by the dog's teeth on the dorsum of the first joint and both phalanges of the left thumb. The wounds were cauterized with pure carbolic acid within 1½ hours after they occurred, and an hour later were again cauterized with a silver nitrate stick.

Treatment was begun on November 23d. At that time scratch marks were the only evidence of the bites. The boy had experienced no abnormal sensation since being bitten and was feeling well.

His course of treatment was as follows:

First day treatment, November 23d, 2 doses of 3 cc. each 13 days cord; second day treatment, November 24th, 2 doses of 3 cc. each 13 days cord; third day treatment, November 26th, 2 doses of 3 cc. each 10 and 9 days cord; fourth day treatment, November 27th, 2 doses of 3 cc. each 8 and 7 days cord; fifth day treatment, November 29th, 1 dose of 3 cc. 5 days cord; sixth day treatment, November 30th, 1 dose of 2 cc. 4 days cord; seventh day treatment December 1st, 1 dose of 2 cc. 3 days cord; eighth day treatment, December 2d, 1 dose of 2½ cc. 3 days cord; ninth day treatment, December 3d, 1 dose of 2½ cc. 4 days cord; tenth day treatment, December 4th, 1 dose of 2½ cc. 3 days cord; eleventh day treatment, December 6th, 1 dose of 2½ cc. 4 days cord; twelfth day treatment, December 7th, 1 dose of 2½ cc. 3 days cord; thirteenth day treatment, December 9th, 1 dose of 2½ cc. 3 days cord; fourteenth day treatment, December 10th, 1 dose of 2 cc. 5 days cord; fifteenth day treatment, December 11th, 1 dose of 2½ cc. 4 days cord; sixteenth day treatment, December 12th, 1 dose of 2½ cc. 4 days cord; seventeenth day treatment, December 13th, 1 dose of 2 cc. 3 days cord; eighteenth day treatment, December 14th, 1 dose of 2½ cc. 3 days cord; nineteenth day treatment, December 15th, 1 dose of 2 cc. 3 days cord; twentieth day treatment, December 16th, 1 dose of 2 cc. 5 days cord; twenty-first day treatment, December 17th, 1 dose of 2 cc. 4 days cord; twenty-second and last day treatment, December 18th, 1 dose of 2 cc. 4 days cord.

The injection caused no pain, except on November 26th and 27th, and on December 17th and 18th, when it produced some burning which soon passed away. A burning pain lasting several minutes occurred shortly after the injection on November 23d and 27th. A little while after the injection was given, a diffuse redness would often appear at the site of the inoculation and below it, lasting from 2 to 24 hours. The virus was absorbed quickly as a rule; on one or two occasions, however, it took several minutes to disappear. The patient stated that shortly after the 3d injection the tissues swelled to half the size of an orange and remained so for ½ hour. After December 1st he complained of intense itching at the site of the injection.

The boy's general health continued good. There was no constitutional disturbance except on one occasion which shall be referred to later. The temperature was as follows:

November 25th, 100.4°; November 26th, 100.2°; November 27th, 100.1°; November 29th, 100.1°; November 30th, 100.1°; December 2d, 99.5°; Decem-

ber 4th, 99.3°; December 6th, 98.6°; December 7th, 98.6°; December 9th, 98.3°; December 10th, 99.1°; December 12th, 98.3°; December 14th, 97.8°; December 15th, 98.6°; December 16th, 99°; and December 13th, 98.6°.

The patient never felt feverish. On November 27th, he said he had a feeling as if something were running down his leg. On December 9th, there was a slight punctiform macular eruption over the abdomen and the back of the hands. The boy complained of an ache in his arm on December 16th.

On the second day of treatment, November 24th, at 5 P. M., I injected 3 cc. of a 13 days cord in each side of the abdomen below and to the outer side of the site of the previous inoculation. This caused no pain. There was no tenderness or pain at the spot where the previous puncture had been made. Three hours after the injection an intense burning pain, compared to that produced by a mustard plaster which has remained on too long, was felt at the site of the injection, lasting 7 hours and preventing sleep. The patient was doubled up and unable to straighten himself. The pain then became less acute, but persisted all day as a dull ache and a soreness, the affected spot being sore and tender. The lad became very pale during his suffering, which was very acute. In the afternoon the tongue was clean, the pulse was 104 and the temperature 100.4°. Except for the soreness, the boy felt well. I applied an antiseptic ointment and gave a cathartic. By the next day the pain and soreness had practically disappeared, and the general condition was good. The temperature was 100.2°. There was no redness at the sites of the inoculations, but there was tenderness over an area roughly semicircular, extending 2 inches below and 2 inches to either side of the point of puncture. At 5 P. M. an injection of 2½ cc. of 10 and 9 days cord was given on each side of the abdomen, above and to the outer side of the site of the first inoculation. After about 1 cc. had been injected, the serum caused some burning which soon ceased. Very severe pain, almost as bad as before, began about 8 P. M. and lasted until the following afternoon, at which time there was deep tenderness and a dull redness about the sites of puncture. These were the only instances of a severe reaction to the treatment.

At no time has the boy shown any symptoms of rabies. Two weeks after the cessation of all treatment, he felt perfectly well, and he has continued well up to my last visit on February 21st.

In conclusion, I feel justified in saying that when a person has been bitten by a rabid dog he need not of necessity go to a Pasteur Institute for treatment. If he lives within a day's journey of a reliable institute, the virus may be sent to him by mail and injected by the family physician. That this can be done with apparent success, the two cases I have reported would seem to show.

DISCUSSION.

DR. ERNEST LAPLACE: In 1885 and 1886 it was my great privilege to be a coworker with Pasteur at the time he made the experiments that have resulted in what is absolutely a preventive treatment of hydrophobia. When I entered the laboratory he had not begun to intensify the virus by passing it through rabbits. Finding that the dog hydrophobia was more virulent than the human,

he sought a method of intensifying the virus with the view of producing immunity and for that purpose he experimented with the monkey in which animal hydrophobia develops in 2 months after inoculation instead of 3 weeks, as in the dog and in the average human case. By that lengthened period it was evident to Pasteur that he was getting in the monkey an attenuated form. Owing to the difficulty of securing monkeys for practical use, he continued his experiments on rabbits and, to his surprise, found that dog hydrophobia of 3 weeks produced hydrophobia in 2 weeks in rabbits, showing that it was intensified and by subsequent inoculation he brought the time down to 9 days. The experiment and treatment in the first case was on a patient named Albert Meister, aged 12 years, who is living still. Six persons were bitten and 5 died. Meister was the only one treated. Pasteur took the precaution of being sure that the dog had hydrophobia. In the paper of this evening only histologic lesions were referred to. To his dying day Pasteur never made a diagnosis of hydrophobia except by inoculation, maintaining that other diseases to which dogs were liable might produce cerebral symptoms, and he would never admit that a dog had hydrophobia unless a piece of the brain or spinal cord were injected into rabbits and they died of hydrophobia. I do not mention this with the view of adopting that method of diagnosis previous to treatment. Such a procedure would take 8 to 10 days and the patient would be endangered; but I believe that for the scientific value of the treatment it is well not to be satisfied when a patient has been bitten by a dog suspected to be rabid with having the treatment instituted, but the brain of the dog should be used for inoculations. The treatment itself produces few or no symptoms. I have seen several hundred inoculated as they came in large numbers from Russia, where in winter the mails are carried through a country in which rabid wolves are waiting for prey. The Russian peasants hearing of the treatment came with faces all mangled and the worst cases of suspected hydrophobia. The statistics of the Pasteur Institute will show the immunity produced by the treatment. There is no doubt in my mind that the treatment is based upon a scientific foundation, although the germ of hydrophobia has not been found. That the poison exists is undeniable. It can be produced and reproduced, attenuated and made more and more virulent at will, and more can be done with the poison than with any other except the poison of anthrax. Pasteur was disposed to look upon this in much the same light as we look upon the morphin habit. Pasteur's idea was to produce in a patient with dog hydrophobia, which requires 3 weeks for development, a tolerance with the rabbit hydrophobia, which is more virulent and takes only 10 days to develop. The pains alluded to I think are usually the result of local causes. It may be that the virus is infected, but, as a rule, there is no inflammatory reaction. Personally, I feel very much pleased to know that the New York Laboratory will send this virus, for the moral effect upon a patient leaving home in a desperate rush for a laboratory is very bad. If treatment can be carried on at home I believe a step has been made of great worth to medicine in general.

DR. WILLIAM M. ANGNEY: In July of last year I had an officer from the western part of the city, who had been bitten at the base of his thumb by a dog which had all the clinical symptoms of rabies. At least 3 dogs were bitten by the animal. We sent out a description of these dogs through the Police Bureau, and they were caught. We tried to get the Bureau of Health to take care of

them in order to see if they would develop rabies in the proper time, but they had no facilities and I was compelled to have the dogs killed. I could not get the dog that did the biting, and I can only say that the bite was from a supposed rabid dog. I followed out the same line of treatment mentioned by Dr. Cohen, with success. We sent the patient to New York for the first 2 days' treatment and after that the virus was sent to me here. For the first few days the treatment seemed to make the man sleepless.

DR. G. MORTON ILLMAN: While Dr. Cohen was reading his paper I could not help thinking how very fortunate his patients were in being attended by a physician who recognizes hydrophobia as a distinct disease, and who promptly instituted a vigorous course of prophylactic treatment. If treated by some physicians, the wound would not even be cauterized; a simple dressing would be applied and the patient dismissed without even a word of warning. The best substance to use in cauterizing the wound is fuming nitric acid. In a series of experiments on animals by Drs. Cabot and Poor, of the New York Board of Health, it was found that when nitric acid was used on infected wounds after even an interval of 24 hours, 90% of the animals did not develop rabies. Nitric acid is far more penetrating than silver nitrate or carbolic acid, it being important that the cauterization in every case go as deep as the bite. It seems peculiar that some men who recognize nephritis and its pathology and tuberculosis and its pathology still deny the existence of hydrophobia and its now definite pathology. In human beings there is in hydrophobia a distinct degeneration of the ganglion cells of the intervertebral ganglia and of the ganglia of the cranial nerves at times going on to a complete destruction. There is also associated with this a proliferation of the cells of the capsule surrounding the ganglion cells, at times completely replacing the ganglion cell. There are also changes in the medulla, and in the bloodvessels, with a collection of small cells around the vessels and nerve cells and minute hemorrhages. In advanced cases the tubercles of Babes can be distinctly demonstrated. Many foreign writers believe that the poison can be transmitted not only by the saliva but also by the blood. I know of no cases reported as being transmitted by means of the blood from animals to man or from man to man. An experience I had with a case of hydrophobia reported to this society a year ago may serve as an example of the noneffect of blood transmission. (Proc. Phila. Co. Med. Soc., December 31, 1903.) While treating the patient in the second day of the spasmodic stage of the disease, I had the misfortune to puncture myself with a hypodermic needle as I withdrew it from the patient's very sensitive arm. The puncture drew blood, but I did not have the part treated until some 2 or 3 hours later, which would have been ample time for any poison to have been taken up by the circulation. I had the part later completely excised, for the performance of which I am greatly indebted to Dr. Frazier. In a case being treated at Scranton some months ago by the Pasteur method, the physician punctured himself with the needle used in treatment, and he at once started treatment for himself; but Dr. Poor who was indirectly attending the case tells me that the needle had been lying in sterile water over night before the accident to the physician occurred; and Dr. Poor thought there was no possible chance of any symptoms developing under those conditions. It is a disgrace to Philadelphia that we are compelled to send to the New York Laboratory in treating these cases. Many large cities of the east

now have their own institutes or a department of this kind connected with the Health Department. Philadelphia should either follow their example or promptly compel the muzzling of all dogs at all seasons of the year, as is the case in Berlin, Australia and many seaport towns of England, where hydrophobia has been reduced to a minimum. If this question is ever brought up for consideration by the city I hope we will have the good will and support of the County Medical Society.

DR. COHEN: In the event of a question arising as to a dog having rabies, if the head be sent to the Pathologist of the State Live Stock Sanitary Board of Pennsylvania, at the Pepper Clinical Laboratory, 35th and Spruce Streets, the ganglia will be examined for the changes diagnostic of the disease. The cases of inflammatory reaction were studied carefully by me, but they did not seem to me to be conditions of infective cellulitis. Before drawing the virus into the syringe, I boiled a cup and allowed it to cool and then poured the virus into it. In cauterizing a wound caused by a dog's bite, fuming nitric acid should be used; a punctured wound should be layed open and fuming nitric acid then applied.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

SYMPOSIUM ON PNEUMONIA.

[March 23.]

The Work of the Commission for the Study of the Acute Respiratory Diseases.

By Thomas Darlington, M. D., of New York.

[By invitation.]

While the general mortality of New York City and of the United States as a whole has steadily decreased in the last thirty years, owing to the improved sanitary conditions and the increase in our knowledge as to the cause and nature of diseases, yet in the case of several diseases the mortality rate has not fallen, but has actually increased. Of these the most notable and important examples are pneumonia and carcinoma. The deathrate from pneumonia has risen steadily, from 1.95 per 1,000 in 1870 to 2.89 per 1,000 in 1903, and the deaths which in 1870 constituted only about 7 percent. of the total deathrate, in 1903 equaled 15 percent. and still further increased in 1904—19.5 percent.

In 1870 the deaths from pulmonary tuberculosis in the Boroughs of Manhattan and the Bronx numbered 4,030—a deathrate of 4.27 per 1,000. In 1903, although thirty-three years had elapsed and the population increased from 943,000 to 2,186,017, the deaths from tuberculosis were only 5,262, and the deathrate was 2.41. Pneumonia now leads all other diseases as a cause of death. Yet the improved conditions of life and the advance in preventive medicine of the past thirty years should have had the same effect (in kind if not in degree) on the prevalence of pneumonia as on that of diarrheal diseases and tuberculosis, both of which have been markedly reduced.

The disease has in some respects been quite thoroughly studied. It has been known for some years that lobar pneumonia is an infection

usually caused by the pneumococcus, the predisposition to such being usually due to exposure to sudden changes of temperature or cold and to overexertion, exhaustion, alcoholism, etc. It is especially fatal in waterside and low, damp districts; is very prevalent among negroes and persons of Irish descent and in those whose occupations keep them subject to sudden changes of temperature; as a rule, it is feebly communicable, but may even become epidemic.

Notwithstanding the increased knowledge of its causation applicable to the prophylaxis of the disease, its incidence and deathrate have steadily increased, and the problem of its prevention has become the most urgent one in preventive medicine. At the request of the Board of Health, the Board of Estimate and Apportionment has appropriated a sum of money for the special investigation of the acute respiratory diseases, and the Board of Health has appointed the following commission to conduct the inquiry: Edward G. Janeway M. D., William Osler, M. D., T. Mitchell Prudden, M. D., L. Emmett Holt, M. D., William H. Welch, M. D., Frank Billings, M. D., J. H. Musser, M. D., Theobald Smith, M. D., and Herman M. Biggs, M. D.

The investigations have proceeded along two main lines—clinical and bacteriologic. Information is especially desired on the following points: (1) The occurrence and virulence of the pneumococcus and organisms related to or resembling it, in the human mouth in health and disease. (2) The evidence and the extent of variations in virulence of the pneumococcus under different conditions.[1] (3) The occurrence of the pneumococcus in children's hospitals, homes and asylums, and the bacteriology of the mouth before and after outbreaks of pneumonia. (4) The vitality of the pneumococcus under various conditions.[2] (5) The value of mouth disinfection. (6) The bacteriology of the air of public places, conveyances and buildings and private dwellings, especially in reference to its dust content, the public buildings to embrace stores, factories, large office buildings, public schools, theaters, hospitals, tenements, and private houses. (7) The clinical evidence of the communicability of pneumonia as shown by the collection of cases in private houses and public institutions. (8) The seasonal relations of pneumonia. (9) The collection of statistics of pneumonia of the different varieties occurring in hospitals, special attention being paid to terminal pneumonia. (10) The collection of evidence as to the proportion of cases in which pneumonia can be regarded as an autoinfection, and the proportion of cases in which there is evidence of the communicability of the infectious agent.

(11) The study of sporadic cases of pneumonia, special attention being given to the relationships of the individual to crowds or to exposure to other cases of pneumonia, and the determination of the presence of the pneumococcus in the mouth in those cases and cases associated with them. (12) The evidence for the belief that pneumonia is infrequent in Arctic regions. (13) A statistical study of pneumonia, covering its prevalence in different latitudes and in different countries and cities, its yearly and seasonal variations and its types and mortality.[3]

We have at present working on the problem two men in the Boston City Hospital; one in Philadelphia under Dr. Welch; one man at Saranac Lake under Dr. Trudeau; one in Mt. Sinai; one in the Babies' Hospital; one at Bellevue; seven in East 16th street, and two in the laboratory of Dr. Prudden, which is the clearing-house for all bacteriologic investigations of this character.

We are studying particularly methods of identification and distribution under various conditions—in hospitals, medical students, laboratory workers; those in outside employment, at the Sea Side Sanitarium; at Saranac Lake under the tuberculosis patients and under the normal condition of the town. We find the pneumococcus in 30 to 70 percent. of these cases in the mouths, while the influenza bacilli are of very wide distribution, causing, of course, acute respiratory diseases, etc.

In the clinical work we have at present, in New York City, four men whose time is devoted specifically to this purpose at various hospitals; while there are many more in other hospitals in other cities.

Autopsies are made in cases of sudden death at hospitals and morgue to find the presence of the pneumococcus in the trachea and bronchi and how deeply they invade the tissues.

REFERENCES.

(1) Investigating the liability of the pneumococcus outside of the body. (2) Differential study of the organisms in pneumonic lungs. (3) Statistical study of the whole world by our former Registrar of Records and Statistician, Dr. Tracy.

Some Recent Developments in the Etiology and Pathology of Pneumonia.

BY WARFIELD T. LONGCOPE, M. D.

Lobar pneumonia, one of the most prevalent diseases, one which is readily recognized in the clinic and unmistakable at the autopsy table, still presents a multitude of important phenomena which are as yet unexplained or misunderstood. It must be acknowledged, but with great regret, that in spite of the vast amount of work which has been done in bacteriology and pathology, neither one of these sciences has made any great contribution which aids in the diagnosis, treatment or prevention of the disease. The most important and immediate cause, the pneumococcus or micrococcus lanceolatus, has been known for several years, but the accessory factors, ones which may be of utmost importance, still remain obscure.

In animals it has always been difficult or impossible to produce the typical lesions of acute lobar pneumonia. Subcutaneous inoculations in rabbits or mice, the most susceptible animals, may lead to a rapid septicemia, endocarditis, fibrinopurulent inflammations of the pleuræ, pericardium and peritoneum, extensive fibrinous exudates in the subcutaneous tissues, sloughing sores or a variety of other conditions, but not to acute lobar pneumonia. Intraperitoneal, intrapleural, intrapulmonary or even intratracheal inoculations lead, in most instances, to more or less the same results, though occasionally investigators have reported doubtful instances of lobar pneumonia following the last method of inoculation. Attempts have frequently been made to imitate the process in man by lowering the resistance of the animals, through exposure to cold and by other injurious methods, but without signal success. Wadsworth, however, has recently found that if animals are first partially immunized against the pneumococcus, and their resistance raised instead of lowered, intratracheal injections of pneumococci give rise, in a large proportion of cases, to extensive lobular pneumonia or to true lobar pneumonia. He believes that by this process of partial immunization the rabbit is brought nearer to the condition of man, who possesses a certain degree of resistance to infection by this organism. Thus, in man, after infection by the pneumococcus, in place of a rapidly fatal septicemia, the lungs sustain the brunt of the assault and in this situation there is set up a localized inflammation.

But this process is not entirely local. In a large percentage of cases pneumococci gain entrance into the blood and produce a systemic

infection. Within the last year, Rosenow has published from Chicago the results of his blood cultures in pneumonia, the longest series so far recorded. The pneumoccoccus was grown from the circulating blood in 91 per cent. of 175 cases. Tizzoni and Panichi have recently contributed some important observations upon the survival of living pneumococci in the blood of immunized rabbits. They find that if cultures of pneumococci are injected intravenously into passively immunized or hypervaccinated rabbits, they may circulate in the blood and be recovered in cultures for weeks, or even months—in one case for 102 days. During this time the animal appears to be perfectly well, though abrasions of the skin or injuries to the soft tissues may form a point of least resistance, and determine the seat of a localized infection.

These experiments, of course, bear directly upon the origin of complications and the mechanism of recurrent infections. Many, and indeed most of the complications of pneumonia may be due to the pneumococcus. In empyema, endocarditis, pericarditis, meningitis and arthritis it plays the part of a pyogenic organism. Its importance as the cause of peritonitis has only recently been emphasized. This complication, as a terminal event at least, is not very infrequent at the Pennsylvania Hospital, as shown by our autopsy records. In the last twenty-three consecutive autopsies upon cases of lobar pneumonia a well marked peritonitis was seen five times. The pneumococcus was recovered in cultures three times, the streptococcus twice. Whether the infection of the peritoneum occurs by extension of the inflammation from the pleura through the diaphragm, or by way of the bloodstream, is as yet undecided. The muscle of the diaphragm, as shown by Coplin, may be the seat of degenerative changes, but it is well recognized that during septicemias, particularly those caused by the streptococcus and the pneumococcus, the serous cavities may occasionally be involved in a purulent inflammation.

As regards the explanation of that most remarkable process, resolution, second in interest only to the crisis, certain observations of Flexner are of importance. Some time ago Salkowski drew attention to the fact that tissues, kept under aseptic conditions outside the body, undergo selfdigestion or autolysis. This process is dependent upon the action of a ferment. Flexner took portions of consolidated lungs and allowed them to remain in the thermostat under toluol, a fluid which prevents the growth of bacteria but does not destroy the digesting ferment. In the stage of grey hepatization the lungs actually

underwent resolution outside the body and in the course of a few days the exudate had liquefied and left a spongy tissue. With the lungs in the stage of red hepatization the condition was different. There was no softening of the exudate. These experiments suggest, of course, that resolution is dependent upon a ferment action, autolysis. The ferment is probably produced by the leukocytes. In grey hepatization, where the exudate contains quantities of leukocytes, autolysis and resolution is rapid; but if, as in red hepatization, the exudate is poor in leukocytes, autolysis can play but a small part and resolution must occur through some longer and more tedious method.

The only experiments which deal with the prognosis of the disease are those of Stuertz. He claims that the virulence of the sputum (that is, the virulence of the pneumococci in the sputum) as tested by animal inoculation, gives a fairly accurate index as to the progression of the disease. By inoculating white mice with fixed quantities of sputum at intervals during the attack he has constructed what he terms a chart of virulence. In fatal cases the mice died within eight to ten and one-half hours after inoculation. In severe cases, where the termination was uncertain, the virulence, as he expresses it, varied from eleven to twenty hours, while in mild cases it was from twenty to thirty-five hours. In cases which recovered the virulence of the sputum fell gradually, rarely abruptly with the crisis. From an elevation of the virulence of the sputum exacerbations of the pneumonic process or pleural complications were suspected before the appearance of physical signs in eight of fourteen cases.

Aside from the blood culture, there are no satisfactory bacteriologic methods of diagnosis. Huber, Neufeld, Jehle, Rosenow, Wadsworth and others have succeeded in obtaining an agglutination of pneumococci with the serum of immunized animals and pneumonia patients, but as yet the difficulties of technique confine such work to the field of experiment. The observation of Rosenow that pneumococci grow abundantly in the serum of pneumonia patients, forming large quantities of acid and, as other writers have also noted, a thick milky cloud, is interesting and suggestive.

It is quite surprising to learn that pneumococci grow luxuriantly in the fresh serum from pneumonia patients, even more profusely than in normal serum. Indeed, fresh serum from animals highly immunized against the pneumococcus does not inhibit their growth, but forms rather an excellent culture medium.

Like the antiserum treatment of many other diseases, the results

obtained with antipneumococcic serum have been on the whole discouraging. An accurate study of the serum from animals vaccinated with cultures of the pneumococcus has brought to light some interesting and important facts. A serum *can* be obtained which will protect animals against many times the fatal dose of a pneumococcus culture. This serum, however, is not bactericidal, as is antityphoid serum, nor has it been shown as antitoxic. Until recently the method by which it protects has remained in great obscurity. The work of Wright and Douglas, Rimpau and Neufeld, and Hektoen and Reudiger, has been of great value in throwing some light upon this interesting problem. Within the last year Wright and Douglas have called attention to a new and important property of both normal and immune sera. This property consists in the preparation of bacteria for phagocytosis, and is dependent upon the action of a substance which they have termed opsonin (from the Greek "I prepare for a meal"). Rimpau and Neufeld working, in ignorance of Wright and Douglas' observation, have pointed out the presence of these opsonins both in antistreptococcus and antipneumococcus serum. Their work was with rabbits. If a mixture of normal rabbit's leukocytes, antipneumococcus serum and pneumococci is put in the thermostat for an hour or two, stained smears will show all the leukocytes packed with bacteria. No phagocytosis appears, however, if normal serum is substituted for the immune serum. Further experiments showed that the antiserum acted not upon the leukocytes, but upon the bacteria, and only upon living bacteria. Hektoen and Reudiger have, moreover, demonstrated that the opsonins are thermolabile substances and are destroyed when heated to 54° to 60° C. They have also made the interesting observation that though normal human blood contains opsonins for streptococci, these substances are not present for pneumococci. This observation can readily be confirmed. If one adds to a little fresh defibrinated human blood a small quantity of a bouillon culture of streptococci, leaves the tube at 37° C. for one hour and then prepares smears as if for a differential count and stains with Wright's mixture the leukocytes will seem to be crowded with cocci, sometimes as many as 100 or 200 in a cell. A second experiment carried out in exactly the same way, but with pneumococci, gives a totally different result. One cannot discover a trace of phagocytosis. We know that phagocytosis does occur in pneumonia for the pneumococci may frequently be seen within the leukocytes of the exudate in the lung. This property of

antipneumococcus serum not possessed by normal serum offers an interesting and novel field for investigation. We can only hope that further studies will throw some light on this fascinating problem of phagocytosis.

The Symptomatology and Diagnosis of Atypical Forms of Pneumonia.

BY J. C. WILSON, M. D.

The term pneumonia, signifying an inflammation of the lungs, is generally applied both clinically and pathologically to two essentially dissimilar conditions—bronchopneumonia and croupous pneumonia. This nosologic error is the more unfortunate since it not rarely happens that cases of the one form of pneumonia bear clinically a more or less superficial resemblance to the other form, and even upon the postmortem table there are, though much more rarely, cases in which a similar superficial resemblance of the lesions of the two forms may be observed. Nor does the use of the terms lobular and lobar pneumonia greatly simplify the matter, for there are cases of bronchopneumonia in which the pulmonary lesions involve the whole of large masses of lung tissue, or even an entire lobe, on the one hand, while upon the other there are cases of croupous pneumonia in which the lesions are limited, circumscribed or even lobular. But these are exceptional.

There is abundant reason to believe that a failure on the part of practitioners to discriminate between these two essentially distinct diseases known as pneumonia, even in cases in which the differential diagnosis is obvious, has been the cause of misleading therapeutic conclusions and rendered much of the statistical data relating to the morbidity and mortality of croupous pneumonia absolutely worthless. It is to be hoped that the clearer and more precise modern methods on the part of the teachers alike of clinical medicine and of pathology, will lead to a more general recognition of the fact that in practice we have to deal daily and side by side with a local inflammatory process and a constitutional infection with a local pulmonary exudate, both of which we call pneumonia, and to differentiate them by the use of the proper qualifying adjectives broncho and croupous. Then, and not until then, will there be value in the statistics.

Words are the tools of thought, and to those who make the distinction referred to habitually and as accurately as circumstances

permit, the classification of the observed facts is comparatively easy and an intelligent scheme of the various forms of pneumonia is possible. To those, however, who fail to make this distinction the subject of the classification of the facts remains elusive and unsatisfactory from every point of view. When the division of the cases into the two groups is systematically made, a large group of cases commonly regarded as atypical at once fall into their proper nosologic category as forms of bronchopneumonia. These include among others, for example, since these remarks are intended to be suggestive and in no sense to constitute a systematic discussion of the subject, acute pneumonic phthisis, syphilitic pneumonia, many of the reported cases being apparently tuberculous, inhalation or deglutition pneumonias, postoperative and anesthesia pneumonias, hypostatic pneumonias and influenzal pneumonias. The pneumonias of other acute infections, especially measles and pertussis, must also be referred to this great group.

Speaking from the etiologic standpoint the initial pneumonia of rare cases of enteric fever—pneumotyphus of the French—though it is not a bronchopneumonia in the ordinary sense, cannot be regarded as an atypical form of croupous pneumonia. On the other hand, the pneumonia which occurs in malaria would appear to be in most instances an intercurrent croupous pneumonia.

When the above cases are referred to their proper nosologic position, there remains to be considered the second great group of cases of croupous pneumonia, probably the most important of the acute infectious diseases of the present historic epoch, just as enteric fever was the most important of the last century, typhus of the previous three centuries and the plague the most important of the middle ages. The plague, typhus and enteric fever have lost their terrors for our civilization because our methods of living are hostile to their spread and we have learned, even if we do not universally practice them, the sanitary laws by which they can be controlled.

Croupous pneumonia yet defies us. We are as ignorant of the causes of its endemic prevalence as our fathers were of the causes of the epidemics of the great pests of their historic times. The problems in regard to it which we are resolutely setting ourselves to solve—for it is a matter of life or death—contain unknown quantities which at present baffle solution. But the great problems of the past have been successfully and brilliantly solved and preventive medicine is capable of this great ordeal of the present.

The typical form of croupous pneumonia, the classical form, is alike at the bedside, upon the postmortem table and in the laboratory as it comes into evidence from both life and death, the very type of an infection in which the clinical phenomena and the pathologic findings are correlated. In the whole domain of clinical pathology it would be difficult to find a better example of conformity to type. Yet here, as in all biologic research, we no sooner recognize the type than our attention is drawn to the variants. Clinically, there is every degree of departure from type to extremes beyond our art to recognize. Pathologically the lesion, however circumscribed, however remote from the ken of the clinician, is definite and characteristic. Symptoms and signs may be at fault but the fibrinous exudate and the pneumococci are there.

It is difficult, therefore, to draw a sharp line between the classical and the atypical cases. Here, as in other uncertain matters in our art, we are compelled to content ourselves with conventions. It is generally agreed among descriptive writers upon croupous pneumonia that the cases occurring in infancy, old age and in drunkards are atypical. Yet most of us have many times seen perfectly typical cases under these conditions. Nevertheless the following forms are generally regarded as differing sufficiently widely from the type to deserve separate and special consideration:

(1) *Pneumonia in infants.*—The local lesion in this form is much more common in the upper lobes than in adults. Like other infectious diseases, at this period of life the attack often sets in with convulsions. Cerebral symptoms, especially torpor, retraction of the muscles of the back of the neck, occasional excitement with muscular twitching, may suggest meningitis. Cough may be slight or, as in cases that I have seen, absent altogether.

(2) *Pneumonia in the aged.*—The disease may develop insidiously and without a chill. Cough and expectoration are slight and the physical signs obscure. There is great tendency to pulmonary edema. The gravity of the constitutional symptoms is altogether out of proportion to the local lesions as indicated by the physical signs. The prognosis is grave.

(3) *Pneumonia in the alcoholic.*—Pneumonia potatorum. This form is often overlooked since the symptoms are masked by those of delirium tremens, especially when the attack occurs during a debauch. The onset is insidious and the fever slight or absent altogether. The stitch in the side, cough and expectoration, even dyspnea, may be

absent and the actual condition recognized only upon routine examination.

A second variety of this form of croupous pneumonia is seen in individuals who are habitual consumers of alcohol in large amounts, but who do not present the signs of intoxication. Here the pneumonia begins in the usual manner, abruptly with a chill, pain in the chest, dyspnea and elevation of temperature. Cardiac failure, septic phenomena and prune-juice expectoration speedily develop and profound asthenia is a characteristic condition. The prognosis in such cases is highly unfavorable.

(4) *Toxic, so-called typhoid pneumonia.*—This condition is a pneumococcus septicemia with secondary infection. The constitutional phenomena are severe; the evidences of pulmonary exudate are slight or absent altogether. Profound asthenia, ataxic symptoms and wandering delirium are often associated with jaundice and gastrointestinal symptoms. A positive diagnosis cannot in all cases be made during life. The pneumococcus has been isolated from the blood.

(5) *Epidemic pneumonia.*—Multiple cases of croupous pneumonia occurring in prisons, garrisons and sometimes in private houses show typical and atypical forms. The cerebral, circulatory and abdominal symptoms of so-called typhoid pneumonia are frequently present and the death rate is high.

(6) *Larval pneumonia.*—Undeveloped forms of pneumonia are occasionally encountered. There are two groups of cases, the more common being those in which the onset is characteristic, with chill, moderately high temperature, the evidences of local exudate speedily following with cough and rusty sputum, the whole process terminating by crisis within two or three days. This form is described as abortive. In other cases the sickness is slight, chilliness being followed by moderate fever with unsatisfactory physical signs and no characteristic expectoration. The diagnosis at best is a probable one, though it becomes more definite when such cases occur during local epidemics and show herpes.

From the standpoint of the pulmonary lesion the following atypical forms are to be considered:

(1) *Upper lobe pneumonia, so-called apex pneumonia.*—This form is common in infants and young children. It occurs also later in life and is sometimes attended with marked cerebral symptoms, while chest pain, cough and expectoration are not marked. In the

absence of a systematic routine physical examination this form of pneumonia may be overlooked.

(2) *Pneumonia migrans.*—Cases of this type are rare. The disease begins with characteristic phenomena, one lobe after another being in turn the seat of the exudate, the regions first involved successively clearing up. The whole course of the disease is prolonged and defervescence is commonly by lysis.

(3) *Central pneumonia.*—The onset may be characteristic and the constitutional phenomena severe. The pulmonary lesion is, however, remote from the periphery of the lung and does not yield definite physical signs. In the course of several days dulness, crepitus and bronchial respiration may be detected, at first over a limited area. The course of the disease is usually characteristic and the termination frequently by crisis.

(4) *Terminal pneumonia.*—Croupous pneumonia constitutes the terminal event in many chronic diseases, especially phthisis, valvular disease of the heart, chronic nephritis, diabetes and disease of the spinal cord. The condition is very often latent, in the first place because it often gives neither constitutional nor local phenomena indicating its presence, and in the second place because the patients are very often too ill to be systematically examined. The condition revéals itself only upon the postmortem table, where circumscribed regions of the lung, or the greater part of a lobe, are found to be the seat of the characteristic fibrinous exudate, very often in the stage of grey hepatization.

(5) *Pneumonia in pulmonary emphysema.*—The constitutional symptoms are commonly well marked, and characteristic, the onset being sudden with chill followed by high fever and cough. Rusty sputum is scanty or absent. Herpes appears, but the emphysematous condition of the lungs fails to reveal the presence of consolidation, and pain in the chest is commonly absent. The greater capacity of the vesicular structure and the diminished richness of the intervesicular capillaries account for the absence of physical signs. The supply of blood from which the coagulable exudate is poured out is less than normal and the vesicular spaces into which it is poured are more capacious.

A lady, aged 76 years, who had long suffered from bronchitis and had become highly emphysematous, had a severe chill with temperature rising above 104°, with cough, herpes, delirium, stupor. Neither dulness nor crepitus could be detected at any part of the chest. Death occurred with the signs of pulmonary edema upon the fourth day.

(6) *Hemorrhagic pneumonia.*—The chill is followed in the course of a few hours by the more or less abundant expectoration of blood and this may continue for several days, gradually diminishing. The course of the disease and the physical signs do not differ in other respects from the ordinary form.

A gentleman more than 90 years of age was suddenly seized with chilliness and epigastric pain radiating to the right. In the course of a few hours he had abundant hemoptysis which recurred at intervals of 10 or 12 hours. He became stuporous with occasional slight cough and tenacious rust-colored sputum, which later, as jaundice developed, became of a greenish-yellow color. The lower lobe of the right lung became consolidated with crepitus followed by bronchial respiration. Death occurred with the signs of pulmonary edema upon the fifth day.

The diagnosis of typical cases of croupous pneumonia is unattended with difficulty. Errors arise much more frequently from carelessness than from ignorance. Too much importance cannot be attached to a systematic routine examination of the chest in all cases of acute disease beginning abruptly with chill followed by fever, or presenting pulmonary symptoms. The diagnosis becomes difficult in proportion as the departure from type becomes more marked. In the extreme forms of atypical pneumonia—the terminal pneumonias—the clinical diagnosis is very often impracticable. Herpes which occurs in more than one-half the cases is of diagnostic importance. The detection of the pneumococcus in the laboratory reinforces the clinical diagnosis. It can only rarely be utilized in diagnosis except to this extent.

The Treatment of Pneumonia.

BY HOBART A. HARE, M. D.

Although our increasing knowledge concerning the relation of microorganisms to disease has impressed upon us the fact that a large number of maladies at one time considered noninfectious are really due to the entrance into the body of a specific germ, it is an undeniable fact that in no instance has our conception of the character of a malady been more materially altered than by the discovery of the micrococcus lanceolatus. While it is true that this discovery has not as yet materially improved our methods of combating the disease in the sense that it has provided us with an efficient antitoxin, or with information which indicates that any drug has a specific

influence, it is also a fact that bacteriology has shown us, as in so many other instances, that the free administration of drugs to a patient suffering from pneumonia is, in many instances, an abuse, and may even diminish the chances of the patient's recovery. Further than this, the recognition that croupous pneumonia is due to a specific germ has shown us the necessity of varying our treatment in different cases, and has impressed upon the practitioner the important fact that in those cases which recover, he must not give himself too much credit, and, conversely, that in those that die, he must not chide himself, or become pessimistic as to the value of drugs.

The statistics which exist as to the mortality of this disease, and therefore those which exist as to the influence of treatment upon it are, I believe, practically useless, because it is impossible to bring together a large number of cases without jumbling instances in which the patient has suffered not only from croupous pneumonia, but from some subacute or chronic illness in which croupous pneumonia has simply been a terminal infection. As a very large majority of cases of croupous pneumonia are instances of terminal infection, or at least, develop as complications of diseases already present, it is manifestly improper to report them with instances in which the disease is essentially primary and in which the patient has to combat but one infection, and that when his system is in a fair state of vital resistance. This fact, which holds true in regard to volumes of statistics, holds true also with the smaller number of cases which are frequently published by individual practitioners who usually fail to carefully separate primary and secondary cases. Again, we are deprived of information concerning the benefit of different lines of treatment by the fact that croupous pneumonia is an exceedingly common disease in old age, so that it is, in one sense, a terminal infection in this condition, attacking the individual when advanced years have deprived him of the ability to withstand invasion by microorganisms. Statistics are also impaired by the fact that many cases of catarrhal pneumonia and acute pneumonic phthisis are reported as cases of croupous pneumonia, or simply as cases of "pneumonia," and it is probable that occasionally an infarction of the lung, or a pulmonary edema due to, renal disease, enters the records as a case of pneumonia. I mention these facts because they indicate why we have no reliable information as to any plan of treatment, and because it impresses upon us the necessity of a careful differentiation of the cases as to whether they are primary and secondary, and further, because they show that

whether primary or secondary, they should be studied in decades of life and with complete information as to the condition of the patient at the time of onset. It is clear, therefore, that he who advocates any single plan of treatment for cases of croupous pneumonia is one who either lacks large experience, or is unable to derive accurate conclusions from such an experience. On the one hand, we see a patient essentially feeble, recover from the disease, and on the other, we see one essentially robust a victim of its onset. To suppose that any plan of treatment of a curative nature can be identical for both patients is manifestly erroneous. The more so, when we recall the fact that not only does vital resistance vary in each patient, but the virulence of the infecting microorganism is remarkably at variance in different instances, not only because of the vital resistance of the patient but because it is well known that the pneumococcus in a germ which is not tenacious of life, and it varies in its power to produce lethal effects.

If it is thought, however, from these preceding remarks, that I believe that there are no remedies of value in croupous pneumonia, I have misled my hearers. While firmly convinced that the disease cannot be cured in the sense that we cure syphilis with mercury, or malarial infection with quinin, I am also firmly convinced that the natural history of the disease may be much modified in a favorable manner by proper medical attention, and, further, I am convinced that while these plans of treatment are, to a large extent, symptomatic, they nevertheless bring the ship through the storm in instances in which without such aid it would surely be wrecked.

In order that my conception of the results of therapeutic interference may be clearly defined, I think we may divide all cases of pneumonia into three classes: (1) Those in which no treatment can be of any value, for though the lesion in the lung may be small, the system is, from the start, overwhelmed by a profound toxemia. (2) Those cases which can only recover if they receive intelligent aid and support at critical periods. (3) There is another class which not only gets well without treatment, but not infrequently in spite of it; for all too frequently we find physicians driven by the patient's friends, and their own anxiety, to the administration of a large number of drugs with the idea that they may do good without the important realization that anything which is powerful enough to do good, may, under certain circumstances, be powerful enough to do harm. These are the cases which make us feel like saying: "Give the patient a

chance," and these are the cases which remind us of the extraordinary bacteriolytic power of the blood, and the remarkable methods by which nature combats disease, and which should make us hesitate before we drop into the cogwheels of such delicate machinery, drugs which may, if wrongly given, disorder or break down this complex mechanism.

Perhaps, too, it may be proper to divide cases of pneumonia into those of small lesions and marked toxemia, and those with large lesions in the lungs and slight toxemia. We have all seen cases representing both these types. In the toxemic class I am free to confess that therapeutic measures cannot promise much, unless it be that by maintaining activity of the kidneys and liver through the action of alkalis and hepatic stimulants, we may eliminate or destroy poisons. Occasionally, too, these cases seem to be benefited by hypodermoclysis, if used in moderate quantity, and very occasionally good results may follow bleeding and hypodermoclysis, or intravenous injection of normal saline solution. Here, again, however, the physician must carefully consider whether the blood has so far lost its bacteriolytic and other powers for good as to be less valuable to the patient thank is salt solution.

The cardiac stimulants which seem to do most good in the toxemic cases are Hoffman's anodyne or aromatic spirit of ammonia. Digitalis is, I think, rarely as valuable at such times.

While strychnin is useful, I am firmly convinced that it is much abused. It i., I think, a whip which should be used to pull the patient out of a critical period, and in the majority of instances the practice of administering it in full dose every three or four hours, day after day, deprives the physician of the whip which he may need, should a crisis arise, and it increases nervous irritation.

Another drug which, for some reason, has become exceedingly popular with the profession in the treatment of pneumonia, is nitroglycerin. Its use in many cases is a lamentable instance of the fact that many of us are willing to administer a drug because we have heard of its doing good in one case, and therefore imagine that it may do good in another. Orignally employed in pneumonia in cases with high arterial tension for the purpose of relieving the heart of extra work, it has come to be employed with the idea that it is a circulatory stimulant, which is an utterly erroneous conception of its physiologic action, and I have frequently seen it given in cases in which the disorder of the heart depended upon vascular relaxation, which was exaggerated by the drug, rather than upon any influence exercised

by the disease upon the heart. When the skin is hot and dry, the kidneys inactive, and the tension high, it, or sweet spirit of nitre which we are prone to forget has a similar physiologic action because of its nitrous ether, are often valuable drugs.

When the first sound of the heart lacks tone, and the pulmonary second sound is accentuated, it is my habit to administer five minims of a physiologically-tested tincture of digitalis every four or eight hours, and every two or four hours, to give ten minims of an equally active tincture of belladonna, the belladonna being given twice as often as the digitalis, because it is fleeting in its effects, while the digitalis is prolonged in its influence. If the fever is high, it has been my experience that it is essential that an icebag should be placed over the heart if we are to get any value from the use of the digitalis. When the circulatory condition is urgent, and the pulse above 100 and gaseous, this treatment aided by the administration of Hoffman's anodyne by the mouth and camphorated oil hypodermically, will often pull a patient through when all other methods fail.

The value of oxygen by inhalation is debatable. Physiology would seem to teach us that it cannot do much good, yet almost every one resorts to it, and it undoubtedly gives comfort to the patient's friends, and sometimes to the patient himself.

There are many other points connected with the treatment of pneumonia in its varied manifestations which might be considered, if time permitted. The last one of importance to which I wish to refer is the use of morphin. In cases in which the kidneys are fairly active, and not diseased, and in which restlessness and delirium deprives the patient of rest and sleep so that the nurse reports at the end of thirty-six hours that the patient has not closed his eyes, I believe that life is often saved by giving a hypodermic injection of morphin, for often several hours of quiet sleep will so refresh a patient that the whole complexion of the case, to use a political phrase, will be different upon his awakening. Like strychnin, however, morphin does best if it is carefully reserved for real emergencies. Strapping the chest, and the use of small doses of codein or heroin or Dover's powder, being used for the relief of pain when the pleura is sufficiently involved to cause this symptom.

If this brief paper has seemed to be iconoclastic or nihilistic, it has failed to convey my real views as to the efficiency of treatment, and in conclusion I would like, as an explanation of my attitude to quote two paragraphs which can be found on the fly-leaf of my book on Therapeutics:

"When called to guide a patient through an illness the physician should be constantly a watchman, and a therapeutist only when necessity arises."

"A good physician is one who, having pure drugs, knows when to use them, how to use them, and, equally important, when not to use them."

The Treatment of the Surgical Complications of Pneumonia.

BY JOHN H. GIBBON, M. D.

Empyema.—Probably the most common surgical complication of pneumonia is empyema. In order to render the surgical treatment of this condition altogether successful it is necessary that the pus in the pleural cavity should be promptly and thoroughly evacuated. That this may be done, every possible diagnostic means should be employed to detect pus as soon as it has formed. Early operation means prompt expansion of the lung and a prompt recovery, whereas a late operation, when the lung is bound down by adhesions and there is a quantity of plastic lymph, means slow expansion of the lung or want of expansion with a slow recovery and the possibility of much more extensive and serious operations being necessary later. In order to confirm a diagnosis of empyema the exploring needle is not only justifiable, but is strongly indicated. Every precaution, however, should be taken to prevent the infection of the pleural cavity or of the fluid contained in it—therefore the skin, the needle and the hands of the person using the needle should be absolutely sterile. Aspiration of an empyema does not cure it and no one should allow himself to be led into the delusion that it will. The detection of pus in the pleural sac should be promptly followed by complete and thorough drainage. Under certain circumstances this may be done without the use of an anesthetic or with local anesthesia, as, for instance, in the empyemas of infancy and in that form of empyema known as empyema necessitatis, where the pus has worked its way between the ribs and is "pointing" as a superficial abscess. Such cases do not stand anesthetics well or prolonged procedures and, therefore, are sometimes best treated by simple incision and drainage with or without a local anesthetic. Excepting in infancy I believe that a rib should be resected in all cases of empyema in order to give com-

plete drainage, provided the patient's condition permits of the administration of a general anesthetic.

The choice of an anesthetic is of very great importance. Personally, I believe that the safest anesthetic in such cases is ethyl chlorid which it is my custom now to use alone or as a precursor of ether in all instances. It is as safe or safer than ether and is devoid of many of the dangers which accompany the latter agent, especially the congestion of the air passages. In Great Britain this agent is being very extensively used, especially for short operations, and at the Pennsylvania Hospital, where most of my operating is done, it is used in a large majority of the cases.

In operating for empyema it is very necessary that the operation should be quickly done, since prolonged anesthesia is accountable, I believe, for much of the mortality after this operation. Excepting in case of an encysted empyema I believe that it is well to drain the pleural cavity low down and, therefore, I usually excise a portion of the ninth rib. If an encysted empyema is present the resection should be done immediately over the point at which the exploring needle has demonstrated the pus to exist. The rib resection should be a subperiosteal one. It is very easy with a thin periosteal elevator to separate the periosteum of the rib throughout its entire circumference, and after this is done a portion of the rib is easily excised without injury to the pleura or to the intercostal vessels which have been pushed away with the periosteum. After a section of the rib has been removed in this manner the opening of the pleura can be done very deliberately. Occasionally the pus is not encountered at once and in such a case it is advisable to pass the finger into the pleural cavity and in all likelihood adhesions will be encountered which, when broken down, will result in the evacuation of a large quantity of pus. If the patient is in a bad condition at the time of operation it is not wise to allow the pus to escape too rapidly, and personally I make no attempt to remove all the pus at the time of operation, but allow it to escape gradually through the tubes. Two drainage tubes should always be inserted and in an adult they should be as large as the finger. Small tubes are apt to become occluded and it is impossible for masses of lymph which are frequently present, to escape through them. There can be no objection to the use of large tubes and when they are employed drainage is much more complete and recovery much more prompt. These tubes should always be sewn to the edges of the wound. Occasionally before inserting the tubes it is wise to remove

large masses of lymph which may be present in the pleural cavity. This saves time, as the liquifying of such masses and their discharge through the tube is a matter of some days or weeks. The removal of such masses of lymph also will often aid the prompt expansion of the lung. No washing out of the pleural cavity is necessary. When this operation is performed promptly after the detection of the pus the recovery takes place easily and is usually complete in a few weeks. If the operation is deferred, drainage has to be kept up for many weeks or possibly months, and in not a few cases second operations have to be performed because of the nonexpansion of the lung. The keynote, then, of success in the treatment of empyema is thorough drainage as soon as the condition has been recognized.

Lung Abscess.—Abscess of the lung, although not so frequent a complication of pneumonia as empyema, is nevertheless not infrequently met with. The most frequent causes of lung abscess are foreign bodies, tuberculosis and pneumonia. The condition may either be single or multiple: pneumonic abscesses are usually single, tuberculous abscesses are often multiple. A certain sign of lung abscess is pus in the sputum. The symptoms are sometimes insidious, the condition not being suspected until a quantity of pus has been evacuated through a bronchus. The exact localization of an abscess is not an easy matter, and the exploring needle, which is so valuable a diagnostic measure in empyema, is not to be used with the same impunity when an abscess is suspected as the danger of infecting a healthy pleura is much greater. Fortunately, however, adhesion between the lung and parietal pleura over the abscess is practically always present. The X-rays have added somewhat to our ability to localize a lung abscess.

Before attempting to evacuate an abscess of the lung the surgeon should first resect one or two ribs over the area in which the abscess is indicated and then introduce an exploring needle or trocar. If pus is encountered the abscess should be then evacuated by a free opening made with a knife or hemostatic forceps. The Paquelin cautery for such purpose does not seem to be used so frequently now as formerly, as it has been shown that the danger of hemorrhage is not so great in these cases as it was once thought to be. Great stress has recently been laid upon the value of palpation in the localization of a lung abscess and it is certainly, excepting for the exploring needle, the most reliable diagnostic means. If the surgeon finds that there are no adhesions between the lung and the chest wall and he has located

an abscess by palpation, two procedures are open; first, immediate drainage through the pleura, and second, allowing the lung to become adherent at the point at which the ribs have been resected with subsequent drainage at this point. Many surgeons now are draining abscesses of the lung through the pleural cavity without waiting for adhesions to form. Unless the patient were in a very bad condition and in great need of immediate drainage, my own inclination would be to wait for twenty-four or forty-eight hours for adhesions to form and then evacuate the pus. Such adhesions may be produced by suturing the lung to the chest wall or by gauze packing.

The surgical treatment of abscess of the lung due to pneumonia is more successful than that of any other variety of lung abscess.

DISCUSSION.

DR. JOHN H. MUSSER: During the past winter I have seen some 42 cases of pneumonia, some of which have presented the following problems: (1) Cases simulating abdominal conditions. The problem in these cases is to decide whether there is inflammation in the upper abdomen, or whether we have to do with infection above the diaphragm. Attention to a few of the classical phenomena that attend pneumonia, on the one hand, and to those which attend disease below the diaphragm, on the other hand, enable a diagnosis to be made. The rusty expectoration, the expiratory grunt or the disturbance of the pulse and respiration ratio, are the most valuable symptoms in the absence of the physical signs, of pneumococcic infection of the lung. We do not get much help from an examination of the blood, because there is a leukocytosis in appendiceal and gall bladder infections as well as in pneumonia. (2) Cases in which a diagnosis must be made between pneumonia and meningitis. The presence or absence of the phenomena which attend meningitis is more helpful in these cases than the pneumonic symptoms. The slow pulse, the rather slow respiration, the scaphoid abdomen and the special sense phenomena are indicative of meningeal trouble. The laboratory diagnosis is not sufficiently satisfactory because of the occurrence of leukocytosis in both infections. Kernig's sign and other phenomena which occur in meningitis are unfortunately sometimes present in the meningismus on meningeal irritation of pneumococcus infection. (3) Cases in which a large hemorrhage at the onset of the disease suggested tuberculosis. The course of the disease in such a case helps us more than do the specific symptoms or laboratory signs. Sputum is often absent, or, if secured, may for a long time be negative, and yet from the general appearance of the individual we may feel that the process is tuberculous rather than pneumonic. Thus far I am free to say that we may have no definite symptoms and signs which enable us to make a diagnosis between these 2 conditions in the first week. (4) Cases in which delirium is so marked during the period of convalescence as to make the case atypical. This delirium, both in hospital and private patients, comes on immediately after the crisis and rages violently for from 3 to 5 days or 2 weeks, unattended by fever or undue change in pulse rate. The patients recover without any unusual cerebral complications. (5) In one case I saw a patient

because of the persistence of fever after the crisis. The temperature was kept up in the case by an acute endocarditis. In none of the cases have I seen empyema follow as a complication. In one case there was abscess of the lung, which I think is not so easily differentiated from empyema as the surgeons would lead us to believe. In the diagnosis of empyema one cannot rely alone on simple exploratory measures with small or moderately large needles, but must often use very large needles in order to secure pus, and indeed, in one of the cases in which I was morally certain of the presence of pus I was unable to demonstrate it in spite of repeated aspirations. Occasionally, in cases in which the symptomatology, course and physical signs make us feel certain that pus is present we are justified in making an incision over the point of possible accumulation of material. It must be remembered that the pus of an empyema does not always gravitate to the bottom of the pleural cavity; often the infection is between the lobes. Therefore a purulent accumulation between the upper and the lower lobe of the left lung, for example, may give obscure physical signs in that region of the chest only. Exploration in this region may be sufficient to determine the presence of pus by aspiration. In one case I was so sure that pus was present that I had a surgeon cut down at once through the third interspace and he found an encysted abscess which I think began between the lobes. I think we are wrong n believing that pneumococcus infection is a self-limited disease, that it will run its course and that the patient will get well. That is true in many cases, but no one can tell how quickly the simplest case may become gravely toxic. I think we should in all these cases have a clear information as to the mode of death, which is usually toxemic but sometimes mechanical. As a mode of procedure in cases which are frank croupous pneumonia in an otherwise healthy individual, I suggest the following: In the first 24 hours of pneumococcus infection whether we see physical signs or not, but in which we are sure there is invasion of the microorganism, we should limit its growth by such therapeutic measures as will counteract the deleterious effects of its toxins. In limiting the growth of the microorganism we do well to attempt to limit the extent of the primary inflammation or of any secondary inflammation that may arise. We should also disinfect the upper air passages in which the microorganisms are developed. In order to allay the consequences of the inflammation we resort to the local use of dry cups and the ice bag. Blood pressure is reduced either by bloodletting or leeches. The exhibition of calomel by the mouth acts as an antiseptic and modifies the gastritis which is present and the purgative action assists in the reduction of blood pressure. In the elimination of toxins we must resort to the use of water internally more than we are accustomed to use it. It should also be used under the skin and by the bowel under certain circumstances. To counteract the toxins we have one or two drugs available, strychnin and a moderate amount of alcohol. There should be the slightest amount of feeding possible. In a patient over 50 I hesitate to give morphin, but the shock of the pain is sometimes so severe that I think it is well to administer the drug. Of the complications that arise none are more grave than those referable to the intestinal tract. I dread tympanites more than any of the cerebral symptoms. It should be treated by limiting the patient's diet, by irrigation of the intestinal tract and by the use of eserin. These measures are, of course, not necessary in all instances, but they are measures which we should have well

in hand and be prepared to use at any time. I have never seen spinal puncture do harm and I am satisfied that it is of great diagnostic value.

DR. JOHN B. ROBERTS: The surgeon comes in contact with traumatic pneumonia, ether pneumonia, pneumonia due to cold from insufficient clothing (no-undershirt pneumonia) in patients in hospitals, croupous pneumonia, influenza pneumonia and septic pneumonia. It is often difficult to determine whether a given case is one of true croupous pneumonia or influenza pneumonia. In this discussion it does not fall to me to speak of the medical treatment, and I shall, therefore, confine myself to a statement of my method of dealing with pneumonia cases by surgical means. In the incipient stage of inflammation of the lungs, which is shown by dulness on percussion, crepitant rales and rise in temperature, prompt and efficient dry cupping should be used. I never lose time by sending for a cupper who would probably put on small glasses, but send for large tumblers and put on ½ dozen of them myself by using small pieces of paper dipped in alcohol to make the vacuum in the glasses. These are left on for ½ hour or more and followed usually by turpentine stupes In sthenic cases of pneumonia, and particularly in pneumonia following gunshot or stab wounds of the lung, or injury of the lung from fractured ribs, venesection is often of great value. I am confident that I have prevented congestion of the lung becoming pneumonia by efficient dry cupping; and that I have also prevented disastrous results from acute pneumonia following injuries of the lung by phlebotomy. In cases with a great deal of mucus in the bronchial tubes, I have seen life apparently saved by inverting the patient in order that gravity might act as a mechanical expectorant. The serous effusion in the pleura which occurs as a complication of pneumonia, should be treated by prompt tapping. This may be done as well with the ordinary hydrocele trocar properly sterilized as with the complicated apparatus known as an aspirator. In empyema it is necessary to promptly evacuate the pus and lymph masses. This is easily done by putting the patient in the semirecumbent posture, freezing the skin with ice and salt, and making a 2½ inch incision with a straight bistoury. It is never necessary to resect a rib in order to get room for evacuation and drainage; and I believe it better not to take the time for resection of a rib, when a patient is in the serious condition for which we operate. If it is found, after a lapse of some weeks, that the lung does not expand and the chest wall does not sink in to close the cavity, resection may be done with much greater safety to the patient than at the time of the original incision. Many cases will never need a rib resected; and even in young children, not over one year old, I have found it easy to get a finger between the ribs and to insert a drainage tube. The incision should be made with a quick thrust of the knife, just as one would open an abscess elsewhere. The wound should be then expanded with 2 fingers to allow the pus to flow, and the mass of lymph to escape. The latter may need to be hooked out with the finger tip. Two rubber drainage tubes placed side by side should be inserted and stitched to the skin, to keep them from falling out of the wound; and should each have a safety pin in the outer end to avoid their being sucked into the chest, if the suture threads should cut through the skin unobserved by the physician. Abscess of the lung should be treated in a similar way, by free incision and boring between the ribs with the finger to evacuate the pus. No resection of rib is needed here. Irrigation is not needed in cases of empyema, unless the temperature should subse-

quently show that the cavity has become septic, as from putrefactive germs. Then it should be washed out once or twice a day with a weak antiseptic solution or with sterile salt solution. The temperature curve indicates when the intervals between the irrigations made be lengthened.

DR. JAMES TYSON: There is no disease we encounter of which it is more difficult to foresee the end than pneumonia, and none to which may be more aptly applied the Hippocratic aphorism: "Experience is fallacious and judgment difficult." For time and again I have seen a case of pneumonia, which though seemingly serious, appeared to have features which made it a little more likely to get well than another similar case, and as often perish. There is no single treatment which may be said to be in any way curative, not even as far as the cold bath treatment of typhoid fever is curative. At the same time, there are measures, many of which have been referred to by Dr. Musser, which cooperate with whatever tendency nature has in the way of selfimmunization or in the way of elimination. I do not believe that treatment is without effect and it should not be ignored. One adjuvant which I would emphasize is the early and prompt use of dry cups, used after the manner described by Dr. Roberts, and repeated for a number of days. Though this may not cut short the disease it makes the patient more comfortable by relieving pain and shortness of breath. Certain cases are favorably influenced by the application of the ice bag to the inflamed lung. Where it has seemed to be less efficient than might be expected, I think disappointment has often been due to an imperfect method of application. Too often one will find the ice bag far away from the place to which it was to have been applied. I am not sure but that after all the best method is to apply to the chest, cloths wrung out of ice cold water and kept on until they become warm. Another advantage of the ice cold cloths is that they induce deep inspiration. They also reduce temperature. I direct their removal as soon as the temperature drops to 100° and reapply them when it rises. Creosote carbonate has acquired considerable popularity in the treatment of pneumonia. It was introduced by a French clinician, and has been especially praised by Dr. Vanzant, of Texas. Wonderful results have been claimed for it, but I fear these are exaggerated. However, I have an idea that it is of service in pneumonia and I am making use of it in every case in which it is not contraindicated. A dose is 10 minims best given every 4 hours in capsule or emulsion. It has seemed to me that fewer cases have died since I have been giving this drug. It is less irritating than creosote. The last case of apical pneumonia which I saw in consultation died with empyema succeeding upon the pneumonic condition. Apical pneumonias, in my experience, are generally milder than the other forms of pneumonia and this is the first case I have lost. They are also more apt to be associated with delirium yet they do not often terminate fatally. Indeed I have sometimes thought cases of pneumonia associated with delirium are also less apt to be fatal in their termination. One would naturally think that delirium is an index of the severity of the intoxication and that such cases are more apt to terminate fatally.

DR. JUDSON DALAND: Dilation of the right ventricle is an important complication of croupous pneumonia. If more than one lobe is involved repeated physical examinations should be made in order to determine the presence and extent of the dilation which so usually occurs. A study of the outline of dulness and the other physical signs will aid. The recognition of this dilation and its

prompt treatment often prevent fatal results. The use of venesection under these circumstances is of special importance. Venesection has been referred to from the standpoint of tension and toxemia, but its employment for the relief of the right heart is particularly important. In no condition of the blood with which I am familiar is the coaguability of the blood greater than in certain of these cases of croupous pneumonia. It seems to me that in this particular class of cases the use of water, particularly alkaline water, in large amounts to reduce the acidity of the urine is of some importance. Our methods of combatting acute croupous pneumonia are few; but I feel that these two complications, right heart failure and cardiac thrombosis, may be favorably influenced by means of venesection, alkaline waters and certain cardiac stimulants such as digitalis, strophanthus and nux vomica,

DR. FRANK WOODBURY: I think that the members would like to hear the President's views upon the subject of the manifestations of the disease in relation to, or as affected by, the mode of entrance of the pneumococcus. For instance, cases occur in which there is pneumococcic meningitis, pleuritis or pericarditis, but in the vast majority of instances the lesion is in the lungs, probably on account of direct local infection through the bronchial mucosa. It has occurred to me that possibly the upper air tract may exceptionally be the infection-atrium for the pneumococcus, and, if so, that the course of the disease might be affected by this circumstance. In health, the secretions of the nasal mucosa are antiseptic and are, as we know, unfavorable to the development of air-borne microorganisms There are, however, pathologic conditions that alter this, as in chronic rhinitis, in which the mucosa of the nasal chambers and nasopharynx become culture-grounds for various forms of bacteria. I would request the President to express his opinion upon the question, whether or not the local infection by the pneumococcus and the entrance of the toxins into the blood, from the upper air passages, might produce the atypical forms which Dr. Wilson has referred to, or explain a pneumococcic septicema without pneumonitis.

DR. JAMES M. ANDERS: It is especially with reference to the treatment that I personally feel inclined to speak, and yet the salient points relating to this aspect of the subject were well covered by Dr. Musser and Dr. Tyson. I believe that our attention should be seriously turned to the objects of treatment mentioned by Dr. Musser, namely, the limitation of area of consolidation or the localized inflammation, to the assistance of nature in her efforts to eliminate the toxins and to the meeting of therapeutic indications as they arise. So far as the subject of the limitation of the inflammation is concerned, as well as that of the elimination of toxins, especially through the kidneys, I have nothing to offer in addition to what has been said. I have an entire confidence in the utility of water in this connection, and believe with Dr. Musser that we give it too sparingly to our pneumonia patients, or at all events, with too little regularity. It should be given regularly and systematically both by day and night. Perhaps not enough has been said with reference to the support of the heart and the maintenance of the peripheral tension in pneumonia. It is a very important question to decide just when we should aid the heart in cases of pneumonia, and if so with what agents. Shall we wait until the pulse tension begins to fall off, the first sound of the heart to become weak, and the second pulmonic sound to be diminished in intensity, or stimulate before this period arrives. Jacobi long ago

well said that the time to treat heart failure in pneumonia is before it occurs. In my experience, after heart failure develops in pneumonia, it steadily increases as the result of augmenting toxemia, and death is almost inevitable. On the other hand, it has seemed to me that when I commenced sufficiently early with cardiac stimulants I was enabled to ward off a failing circulation. Whiskey, as has been said by Dr. Hare, in his paper, is a good whip, but does not suffice for long, and something must soon or late be combined with it. Strychnin, in my experience, is the best agent for this purpose. If digitalis is to be given it should be combined with the ice coil and in anxious cases administered early. We should differentiate between those cardiac stimulants by means of which we would maintain the cardiosystemic circulation and prevent heart failure, and those which should be used after cardiac failure has actually supervened. The best among the latter class are, camphor in sterilized oil, strychinin and adrenalin chlorid—all to be administered hypodermically. Nitroglycerin is another most valuable remedy. We do not employ nitroglycerin as commonly as we should in connection with digitalis. By the judicious combined use of these agents we can gradually lower the peripheral tension and increase cardiac strength, when this is desirable, thus conserving the force of the heart and at the same time lessening its work. Adrenalin chlorid is powerful in exalting the peripheral tension and it should not be too long continued, since it may eventually paralyze the heart by increasing the peripheral resistance to the circulating blood to too great an extent. In reference to the modes of infection in croupous pneumonia, I do not doubt that the commonest infection atrium for the pneumococcus is the smaller bronchi. The cases that follow catarrhal conditions of the upper air passages are instances of extension of the pneumococcus infection from above downward.

DR. GITHENS: I have found in my work in experimental pathology that injections of adrenalin chlorid in rabbits cause punctate hemorrhages throughout the lungs and if the dose is too large, death occurs promptly from pulmonary edema. It seems to me that a similar effect may account for some of the bad results seen after the use of this drug in pneumonia.

DR. DARLINGTON: I have been much interested in this discussion and I think I might add one or two words because my experience extends a little bit outside of the Health Commissionership. In the first place, in reference to the drinking of water; I had lobar pneumonia myself 10 years ago. I was down with 6 others, all of whom died. We were out in Arizona. These men were accustomed to a different kind of drink, and you couldn't get water into them. I took it in great quantities in the course of the disease, and I am a monument to the drinking of water in pneumonia. I give quinin in large doses. The result of the remedy depends upon the particular epidemic. Last year pneumonia was very fatal; this year it is not so fatal. The result depends upon the year in which you give your remedy. In reference to Dr. Anders' remarks about stimulants. In all the cases that I have noticed, if you give the stimulant only when the heart commences to fail, the failure will be complete. A great many practitioners use nitroglycerin with ammonium chlorid, but they are absolutely incompatible.

A Case of Fracture of the Fifth Cervical Vertebra with Partial Recovery.

BY CHARLES W. BURR, M. D.

[Read March 8.]

The patient I am about to exhibit is interesting because the most frequent result of fracture in the cervical region of the spine is death, either immediately or soon after the injury. The fact that this man has recovered so largely, means that for some reason the spinal cord itself escaped serious injury. The symptoms existing at the present time are doubtless due to a traumatic external pachymeningitis. The man's history is as follows: B. D., white, aged 56 years, fell from a wagon striking the neck and shoulders in November, 1898. On recovering consciousness he found himself in a hospital. He suffered great pain in the back of the neck, shoulders and arms. The arms he could not move at all, but says he had some power of movement in the legs. He does not remember whether he suffered from priapism. Six weeks after the injury he was brought to the Philadelphia General Hospital. At that time he walked quite well, save for some rigidity in the legs. He held the arms close against the sides. With effort he could flex the forearms upon the arms and slightly abduct the arms. The grip was very weak. The difficulty in movement was caused partly by palsy, partly by pain. There was no anesthesia anywhere upon the body. The biceps jerk and triceps jerk were absent. The kneejerks were increased. There was no muscular wasting. There was great pain in the back of the neck and arms, and sensitiveness to pressure along the spine, especially in the cervical region. The neck muscles were stiff. The head was bent forward upon the chest. All movements of the head were restricted and caused great pain. He had slight spasmodic retention of urine. The bowels were normal. In the course of time he improved a great deal, so that now he walks well. He has regained power in the arms so that now he can put on his coat without difficulty. The muscles of the neck are stiff and board like. The grip is still weak. There is slight wasting of the posterior parts of both deltoid muscles, but no atrophy elsewhere. The kneejerks are normal. The biceps jerk is present on both sides. He has to pass urine frequently, but can hold it several hours. Sensibility to touch, pain and temperature is normal all over the body. My friend, Dr. Kassabian, made a skiagraph of the cervical spine which reveals a fracture of the laminæ and spine of the fifth cervical vertebra with dislocation and possibly fracture of the body.

DISCUSSION.

Dr. M. K. KASSABIAN: This case is very interesting from the neurologic, surgical and skiagraphic standpoints. The frequency and fatality of fractures of the spinal column (in comparing with the fractures of the other parts of the body) has been variously estimated by different authorities. According to the statistics of the London Hospital, fracture of the spine formed 3.3 per cent. of the 52,000 fractures that occurred in 30 years. Stimson's statistics show 0.5 per cent. of 7,000 fractures. This percentage has been altered and increased since the introduction of the Röntgen rays. My own statistics, which are based upon the skiagraphic examinations of 1,500 fractures in hospital and private work, show 1 case of fracture of spinous process and chipping off the body of the fifth cervical vertebra with displacement (Dr. Burr's case); 1 case of backward dislocation of the fifth cervical vertebra (Dr. Spiller's case, both are living now); 1 case of fracture, dislocation of the sixth cervical; 1 case of fracture, dislocation of the second thoracic (both dead); 1 case of fracture, dislocation of the eleventh thoracic (living); 1 case of fracture and displacement of the first lumbar vertebra (died); 1 case of fracture and displacement of the second coccygeal. The above 7 cases demonstrate 0.5 per cent. The detection, location and differentiation of the fractures of the spinal column from dislocation and other injuries, by means of X-rays, is very difficult, on account of anatomic peculiarities and difficulties experienced in bringing the vertebra and its various parts and processes near to the plate.

DR. MORRIS BOOTH MILLER: I saw this patient for Dr. Burr, and within the last few months I have had the opportunity of seeing another patient with practically the same injury, and still another with fracture of the third cervical vertebra involving only the spinous process. It is substantially true that men die when they break their necks, but if they do not they become more or less chronic invalids with paralysis of greater or lesser extent. This man has been fortunate in having his strength and functions restored to a marked degree. I think that, as a rule, these cases are not subjects for operation. Laminectomy for fracture of the spine above the midthoracic-dorsal region is an exceedingly hazardous procedure and operation should only be undertaken when there is positive indication of hemorrhage external to the cord, or when there is direct bone pressure. There are forms of surgical treatment which can be adopted with fair results. This man has done well because he has ankylosis between the fourth, fifth and sixth vertebræ. If we can secure ankylosis we have a fair chance of slow absorption of hemorrhage and gradual restoration of function. To obtain this no device is better than a modified jurymast, extending the neck and supported by the shoulders. By this we may get ankylosis in 6 or 7 weeks and can accomplish more than by surgical interference in such dangerous areas.

DR. M. H. FUSSELL: In connection with the statistics mentioned by Dr. Kassabian it may be of interest to state that at St. Timothy's Hospital in 11 years, in a not very large fracture list, I know of 4 cases of fracture of the spine, all of which were fatal.

Surgical Intervention in Cases of General Peritonitis from Typhoid Fever and Acute Gonococcus Infection.

BY JOSEPH PRICE, M. D.

[Read Feb. 22.]

In many discussions over the treatment of peritonitis, due to traumatism, in the special county and national societies, the struggles of the pioneers were earnest and severe. In the American Medical Association Meetings held in Cincinnati and Newport, the battle was fierce. In no other region or special surgical procedure has the battle been so generally fierce and continuous and the opposition so personal and galling to the young surgeon with good motives and magnificent courage. The obstructionists among the teachers and the professed intelligent profession were unjust and slow in accepting the overwhelming evidence of the operating table and clinical facts never to be altered by theory or speculation. Baker Brown says it is peritonitis that beats us. Mr. Tait says now we beat peritonitis. His pupils and followers have added much to what he simply asked them to try. We save patients dying of visceral fractures, incisions, stab-wounds, shot-wounds and all varieties of pathologic perforations. Our literature is becoming very scientific and precise. The pioneers had nothing to read. Now the papers are classical and exhaustive. Some very valuable books have recently appeared upon the pathology and diagnosis of abdominal disease. Especially to be noted is Douglas's book for the general practitioner. It is accurate, scholarly and clinically instructive throughout. A few of the early surgical obstructionists and doubting Thomases are now the most aggressive and persistent advocates of early surgical intervention in abdominal traumatism and pathology. There is no excuse at present for delay or procrastination. Our present precise knowledge of pathology and diagnosis, with splendid guiding literature, enables every practitioner, who keeps up with his profession, to recognize early the dangerous nature of the accide t or lesion in his patient. The workers seem satisfied with their knowledge of pelvic disease, the clinical course of tubal and ovarian suppurations, of appendicitis, of gall bladder disease, and commendably turn their attentions to typhoid perforations, to gastric and duodenal ulcers, to renal and pancreatic pathology. Some of these maladies are no longer considered rare and now receive the attention they merit; McMurtrie, Weir, Murphy, Mayo, Deaver, Morris and Douglas have all been early and late contributors, theoretically and practically.

The contributions by Finney, Cushing, McCrae and Mitchell on the surgical features of typhoid fever and perforating typhoid ulcers are the most valuable and worthy of careful study. The advisability of surgical intervention for suppurative or infectious varieties of peritonitis and perforating ulcers was suggested by a few authors and teachers throughout the seventeenth, eighteenth and nineteenth centuries, but nothing of a positive nature was done until about 1878. We then began to operate for purulent peritonitis following criminal abortions, traumatism, appendicitis, and all sorts of perforations, and only a small percentage of the cases actually operated upon are recorded. In a good number of cases the peritoneal cavity and its contents were so dirty and disorganized that in many instances the operator failed to recognize more than general adhesions and filth, doing an imperfect toilet and drainage. The recoveries were sufficient to encourage him to do the work earlier, and if possible to do it better; to study the extent of the trouble, seek lesions, find them, cleanse and repair them, drain and be rewarded by a higher percentage of recoveries; and now we realize the vital importance of an early and accurate differential diagnosis and then the great importance of speedy and complete repair. The prolonged apprenticeships of industrious and studious residents in good hospitals are giving us a new and stronger class of surgeons. Again, no one annoys them or places anything in their way. They have a gold ladle in their fingers and magnificent hospitals with every possible appointment at their command for perfect early work. Again, they have the cooperation of specialists in diagnosis, their clinical colleagues; if they do not do good work, it is because all common sense has been educated out of them, a process of retrograde displacement.

Embolism of large and small mesenteric vessels has not received the attention it deserves. Thrombophlebitis, cellular infiltration following any variety of peritonitis or infection should be anticipated surgically. I have dealt with a large number of perforations in about all the viscera in the peritoneal cavity, typhoid perforations, tuberculous perforations and suppurations, gall bladder, gastric and duodenal perforations, and I am satisfied, from the long personal experience, that about all these sufferers should be saved. It's the soiling of viscera and the extensive infection and prolonged sepsis that kills. The surgery is commonly short and simple, if done early. Fatal peritonitis without complete or absolute perforation does occur. Walled off theories are dangerous and unreliable; the feeble pathologic walls

rarely hold for any length of time, while pathologic fluids or products are increasing in quantity and in pressure. I have sometimes felt after an earnest discussion that I would have rather been at home quietly at work, but a few weeks or a month later learned through a variety of sources that the discussion did great good; for instance, the discussion at Atlantic City on appendicitis lowered the mortality of that disease in about every hospital in the country. In one very large and prominent hospital it reduced it 14 per cent. Prior to the discussion the mortality was 14 per cent.—in the last 140 cases there has not been a death.

Typhoid and other perforations are always followed by peritonitis, local or general. The possibility of its remaining local or circumscribed by adhesions should not be considered, if the diagnosis of perforation has been made. Characteristic symptoms of perforation are now well known. Death from peritonitis without any discoverable postmortem lesion of the bowel is due to leakage from softened mesenteric glands, abscess of liver and perforating ulcers of the gall bladder. Lesions favoring general septic peritontitis and general septic conditions are easily arrested by early toilets and free drainage.

The characteristic symptoms of typhoid perforation are sharp, sudden abdominal pains, mild or severe collapse, nausea and vomiting in a good percentage of the cases, falling temperature early, followed by a rise in the temperature. The above symptoms, occurring in a typhoid running a uniform course, are rarely overlooked by the doctor or nurse. Perforation and hemorrhage are the two accidents in such a case that are commonly anticipated. In more than 75 per cent. of the cases recorded general septic peritonitis has been found with escaping bowel contents, gas and feces, foul pus, and free exudate in considerable quantity. The perforations are quickly and easily found near the ileocecal valve; rarely multiple or ragged. Whether of large or small caliber, fine pure silk is the safest material; you can safely reduce the lumen of the bowel to one-half. I am satisfied the interrupted suture gives the best result and less risk of strangulation.

If the margins of the ulcer are ragged they should be trimmed. A resection is an unjustifiable and a dangerous procedure; simply anchor the ragged ulcer and disorganized bowel with catgut sutures in the opening between drains, forming an artificial anus or fecal fistula, which is a much safer procedure and is commonly followed by spontaneous closure. If this result does not follow the fistula can be easily remedied after convalescence.

Early in the history of the surgical management of infectious or suppurative forms of peritonitis, freeing of adhesions, free irrigation or a general wash toilet followed by local or multiple drains was the common practice. Later some good surgeons simply incised and placed one or more drains in free spaces, others freed adhesions and dried the exposed dirty surfaces with gauze; or did a dry and drainage operation and placed drains. The followers of the dry method now claim good results.

The irrigation or wash toilet, so long practiced, has unquestionably given the best results. It should be a thorough cleansing with sterilized water—the entire surface, both the visceral and parietal peritoneum. It is my impression that irrigation with hot normal salt solution is harmful by irritation. Curetting or wiping dirty points with gauze is followed by good results.

About every prominent operator is now saving patients dying from some suppurative or septic forms of peritonitis by either wet or dry toilet, a small or a large drain, or an open treatment. A few years ago some of the same operators stated that just such conditions could not be treated successfully, and now some of them, saved by drains, think their cases should recover more promptly without them. I am satisfied most operators recognize the fact that it is difficult to satisfactorily cleanse a dirty peritoneal cavity, and after making an earnest effort to do so, we place multiple drains or commonly practice the open method that has given us the best results. The gauze pack, so commonly and recklessly used, is a dangerous procedure favoring too many acute and chronic obstructions by pressure. Unless the operator understands how to place gauze drains or cofferdams in and about filthy surfaces, he had better fill the peritoneal cavity with hot salt solution and close. Dr. J. M. T. Finney in his excellent paper on "Surgical Treatment of Typhoid Ulcer," in discussing the relative merits of irrigation and drainage says: "the facts stated that in seventeen of the twenty-three cases that recovered, irrigation of the peritoneal cavity was employed, speaks strongly for the efficacy of this measure In but eight cases of the entire number was wiping used, two of which recovered.

I make a plea for early diagnosis, early surgery and for a practice of more thorough and sterilizing toilets to arrest peritonitis and sepsis. If you succeed in arresting infection or sepsis by toilets, by drainage or by the use of sterilized salt or other solutions you will succeed in the saving of about all these sufferers. It is lamentable that we get

but few timely opportunities. While I save the few, I see as many or more dying without an effort to save them; some die while the instruments are in the sterilizer.

DISCUSSION.

DR. ERNEST LAPLACE: The points brought out by Dr. Price are of great actual importance. If we could only operate on cases of peritonitis at the time that we feel we should have operated upon them, the majority of them would get well. They die because they come to the surgeon too late. The trouble is sometimes on the part of the patients in not calling in the doctor in time, but I believe that oftener it is on the part of the physician for not calling in the surgeon early enough. I am sorry to say that the cases of peritonitis that have died in my hands could have been more early and accurately diagnosed by the physician. Dr. Price's paper combined 2 distinct problems regarding peritonitis. One is, peritonitis as produced by perforating typhoid ulcer and the other diffuse peritonitis from every other cause. There is an important point of difference concerning the surgeon's work in dealing with these 2 conditions. When a typhoid fever ulcer perforates, the contents of the intestines that flow into the peritoneal cavity are largely harmless at the time; it takes a little while for these germs that were doing their normal work within the intestine to become pathogenic. Now and then, we hear of a successful treatment of a case of perforating typhoid ulcer as well as a round ulcer, undertaken 24 hours after the perforation. In such a case for a good while the fecal matter was harmless and had barely begun to generate a pathogenic quality and peritonitis; the virulent sense of the term did not exist then. If such a case gets well the poison was local and the condition gotten rid of by the cleansing operation. Quite a different thing it is to undertake the treatment of a foul peritonitis resulting from a gangrenous appendix or from the rupture of an appendiceal abscess that has gradually leaked into the abdominal cavity. We are apt to overlook in the pathology, the intensity of the virulence of germs. We all know that an abscess opened early will heal quickly—I am speaking of the surface of the body—and that if the abscess is left unopened the germs will acquire virulence the longer it remains closed. If an appendiceal abscess should break general peritonitis would result immediately. There are 2 conditions: one, in which the trouble is local, and the other in which there is the invasion of the general system by that poison. No surgeon can today cure a case of peritonitis where, over and above the local peritonitis, there is general septicemia. Such a case is absolutely hopeless from the first. Therefore, we must exclude from this discussion that kind of a case. It is a condition that should not be allowed to develop. I, personally, believe that the vast majority of typhoid perforations could be cured if the diagnosis were made early enough. It is not the peritonitis that we want the physician to diagnose; we only want him to tell us that the patient is doing worse than the day before. When both the physician and the suregon agree that perforation is taking place, that is the time to interfere. In other forms of peritonitis, especially those related to appendicitis, we find a central peritonitis bound down by adhesions which adhesions are on the point of rupturing. The surgeon must here know that prudence is the better part of valor and, before opening the abscess, he must have the abdominal wound so well cofferdammed that when the

abscess is opened none of the pus will contaminate the general peritoneal cavity. When the pus is all taken out he can disturb the adhesions and hunt for the obnoxious appendix. If the abscess has burst the day before and the case comes as one of general peritonitis he should clean out the abscess cavity in particular and the peritoneal cavity in general. I believe with Dr. Price that this is best done by sterile water. I am of the opinion that the much vaunted saline solution is objectionable, for in a case of conjunctivitis in one eye I have put a drop of saline solution in the normal eye and found it to be painless; but the same solution dropped into the inflamed eye was painful. Therefore, I conclude that the same irritation may go on in the already inflamed peritoneal cavity and that saline solution has very little power as an antiseptic, while it may do great harm as an irritant. I have discarded it in the severely inflamed peritoneal cavity. I believe the abdominal cavity should be cleansed as thoroughly and possibly as long as the patient can stand it without detriment to his general condition. It stands to reason that any infection that is generalized will be best cleansed by a continuous application of that remedy from which you derive so much good during a short while. Each case should be treated upon its particular merits in this respect. With that object in view, I devised a principle of continuous irrigation for general peritonitis. I put one tube down into the pelvic cavity, another at the upper extremity of the wound, and taking a large curved trocar I penetrate the abdominal wall a couple of inches above the spine of the pubes on each side, placing one tube on each side and also a tube above and one below at each extremity of the abdominal incision. At first I maintained a continuous irrigation, but have since modified it to one of repeated irrigation. The irrigator is put into each tube for a few minutes every hour for the first 6 to 8 hours so long as it does not act to the detriment of the patient. It not only washes out the peritoneal cavity but dissolves the toxins which would be formed were the case to do worse. While the temperature and pulse records are valuable with reference to shock, they give no information with reference to operation. We should operate on the general appearance of the patient. The toxins have a direct effect on the secretions and the tongue. In washing out the abdominal cavity I am careful to abstain from using gauze, which will do as much harm as using it on the eye. Pour the water in and use the smooth surface of your glove or bare hand rather than use gauze. Finally, I wish to give a word of warning as to the use of iodoform gauze extensively within the abdominal cavity. While it is a great power for good in some wounds, in others it is a power for evil. In some cases the iodoform has been the source of increased inflammation. The cofferdamming should be done with ordinary sterile gauze. If iodoform gauze is used at all, it should cover only the spot that was the seat of the abscess and should be entirely separated from the rest of the abdominal cavity by the plain gauze that is used.

DR. JOHN H. GIBBON: The subject is of great interest to every surgeon and one upon which we are now coming to agree. Even in my short career I have had opportunity to observe the great change in the attitude of both physician and surgeon toward peritonitis. The question is not one of diagnosis of peritonitis, but the early recognition of the cause of peritonitis. This is particularly true of typhoid perforation. Dr. Price's 4 successive recoveries after operation for typhoid perforation is an unusual experience. McCrea of Pittsburg reported

5 successive cases, but that was unique. The large number of typhoid perforations recently published in the *Annals of Surgery* by Drs. Harte and Ashhurst show a recovery of about 25% in the series of about 400 cases. The diagnosis of typhoid perforation I do not believe is always easy. It is a great mistake to wait until we get the typical symptoms of perforation before we operate or before the surgeon is called in; I mean, the typical symptoms of obliteration of liver dulness, distended abdomen and persistent vomiting. It is rarely that such a patient will be saved. The most valuable symptoms to a surgeon in the diagnosis of typhoid perforation are localized pain and localized rigidity coming on suddenly. In 99 out of 100 such cases the patient should be operated on. Sometimes we will not find perforation as has happened in a few cases at the Pennsylvania Hospital. When you find no perforation you will often find the cause of the symptoms which have induced you to operate and you will be able to remove it. I had this experience in a case seen with Dr. Morris Lewis, that of a young Italian who had symptoms of pain, and rigidity in the right lower quadrant of the abdomen, but I did not believe he had perforation but thought that he did have a localized peritonitis. I opened him and found that he had appendicitis due to typhoid ulceration. He had 4 typical typhoid ulcers in the appendix but no perforation. The best results are obtained in typhoid perforation in cases in which the opening has been pin-point in size and covered with lymph. The diagnosis of perforation of the large intestine is most difficult, since the symptoms come on insidiously due to the more or less fixed position of this bowel as compared to the freely movable ileum. The surgical opinion regarding the best time for operation has undergone much change. Dr. Keen, in his work on "The Surgical Complications of Typhoid," said that the best results were obtained from operations done between the sixth and twelfth hour after perforation. This was certainly true at the time of his publication. The report of Drs. Harte and Ashhurst shows distinctly that the time to operate on typhoid perforation is when you make the diagnosis. I do not believe we should ever wait for a patient to recover from "primary shock." The time for the surgeon to see the patient is when the sudden pain occurs. I think that every member of the medical staff of the Pennsylvania Hospital has left an order with the Chief Resident that when a typhoid patient is seized with pain in the abdomen the surgeon is to be sent for at once. I agree with Dr. Price that resection is hazardous. In a case at St. Joseph's Hospital of a large perforation of the small bowel, which it was impossible to close, I did a resection hurriedly with the Murphy button. The patient died, though I think he would have died had I not resected. I think time is of the greatest importance in these operations. McCrea's operations were all done under a local anesthetic, and this method is becoming quite popular. Dr. Harte considers the time the patient is on the table the greatest essential. It is surprising to learn how much more bowel can be turned in with an ulcer than is supposed. In one of my cases which died on the tenth day from a secondary perforation a postmortem examination showed that the bowel at the site of the previous perforation was as large as at any place and that it had entirely healed. Anchoring the bowel, surrounding it with cofferdams of gauze is the best procedure, where the perforation is very large. The established fistula is low down in the small intestine and the patients do not die from want of nourishment as when the perforation is higher up. With localized peritonitis I believe that

thorough drainage is better than thorough irrigation. Generalized peritonitis demands complete irrigation. Murphy reported 2 or 3 cases of typhoid perforation in which he simply put in a drain and the patients recovered. We can operate upon chronic suppurative conditions in the abdominal cavity, such as pus tubes, and dispense with drainage; but a man who removes a gangrenous appendix and closes the abdomen will lose his patient from extension of the peritonitis or will have a secondary abscess. I am hardly prepared to agree with Dr. Laplace regarding the irritant effects of saline solutions, and particularly if his opinion is only based upon the experiment upon the eye. We know that boric acid is painful to the inflamed eye, but we know it does good; and this is also true of silver nitrate solution. Likewise, I believe that the application of salt solution to the peritoneum, although it might give pain, does good.

DR. B. F. BAER: My experience with salt solution in abdominal operations differs from that of Dr. Price and Dr. Laplace. I had, during a few years of my earlier practice, used plain warm water; then had given it up for a time and worked with a dry technique; but for the last few years I have employed normal salt solution in almost every case; and in all, except the drained cases, a quantity is left in the peritoneal cavity for absorption. As the patients nearly all recover (I speak now of the ordinary chronic cases, and not of those of typhoid perforation and fulminating appendicitis), the saline solution cannot, therefore, have the irritating quality ascribed to it in this discussion. I use the solution because I think it nourishes the patient by restoring to the bloodvessels and tissues a fluid of which they have been depleted by the disease and by the operation. It quenches thirst, improves the action of the kidneys and skin, and, I believe, it has a good influence in preventing postoperative adhesions. Of course, I do not know this, but I do know that after a large experience with both the wet and dry toilette, I have become convinced that the former is most satisfactory; and I regard it as a decided help to a prompt convalescence.

DR. ERNEST LAPLACE: I thought I was explicit in saying that I thought salt solution would irritate in a case of general peritonitis where we can only expect a cleansing effect from the washing, and where the small amount of salt in solution is not enough to prove an antiseptic but is sufficient to slightly increase the irritation. I believe I am not the only one who has found this out.

DR. EDMUND W. HOLMES: It seems to be the fashion to blame the medical men for losing cases of typhoid perforation because the diagnosis is not made soon enough. I am glad to hear Dr. Gibbon say that he has found that the diagnosis of typhoid perforation is exceedingly difficult. The medical men are not always to blame, when we hear such an authority as Dr. Price say that he believes the symptoms of typhoid perforation are a drop in the temperature and symptoms of shock. We find out that if we wait that long for the diagnosis of typhoid perforation that there is often little use to operate; so that we have to advise the family that the patient's chances are small, and, therefore, cannot blame the medical men when surgeons do not agree any more than those who have already spoken. I agree with Dr. Gibbon that the surgeons are at fault in not operating soon enough. He says that at the Pennsylvania Hospital the surgeon is sent for if pain in a typhoid case comes on suddenly, and frequently the operation is performed without the medical chief being present; if I understood him rightly, that is almost too radical. Sudden pain, sudden rigidity, sudden tenderness

in the abdomen with some interference with respiratory action form a good indication for operation. In my experience the temperature is no indication at all. The majority of the symptoms usually ascribed to perforation are really symptoms of peritonitis and shock and not of perforation itself. I had a case recently in which I diagnosed perforation of the bowel before the medical man had diagnosed typhoid fever. The patient was in a state of collapse and, it is needless to say, died a few hours after the operation. I believe the surgeons ought to agree that we should be willing to open the abdomen, even though, in so doing, we find no perforation in a certain number of cases, rather than let them go until the umnistakable symptoms are present. We should agree that the 4 symptoms, pain, localized tenderness, abdominal rigidity and some interference with respiratorn action, indicate the need for operative interference.

DR. GIBBON: I would like to say that Dr. Holmes misunderstood me. I do not disagree with anything that Dr. Price or Dr. Laplace said regarding the treatment of typhoid perforation or the time of operation. I said I did think there were cases in which the diagnosis was not so easy as these gentlemen might have indicated. So far as the time when operation should be done is concerned, I think surgeons are unanimous in opinion. Regarding the plan at the Pennsylvania Hospital, I would not misrepresent that institution. What I said was that if a typhoid patient suddenly developed localised pain and rigidity the surgeon was immediately sent for, and that if he believed perforation was present he operated then and there, whether or not the medical man was present. This does not mean that every case that develops pain and rigidity is operated upon.

DR. ROBERT N. WILLSON: I believe there will, in the not far distant future, be a time when typhoid fever cases will be treated in such a way that they will not reach the surgeon; that there will be an intestinal antiseptic found which will actually reach the bowel, and by means of which typhoid perforations will be prevented.

DR. R. P. MCREYNOLDS: I would like to ask Dr. Price how many cases of typhoid perforation he has operated on; he says he has "saved nearly all." It seems to me that he was peculiarly fortunate in the case reported to us tonight: a man who had practically recovered from typhoid fever, who went to a hotel by himself, who was taken with pain in the abdomen at night, and who was operated upon the next day with his pulse at 104. It is not often that a patient is in such good condition as this one was from the start. I think the diagnosis of typhoid perforation is particularly difficult. I have been unfortunate enough to operate on one or 2 cases and not to find a perforation which I thought existed. It seems to me that the cases of peritonitis from gonorrheal infection all get well if let alone. The temperature comes down to normal if they are kept in bed, given hot douches and treated by the expectant method. I see no reason why they should be operated on in the acute stage. My rule is to wait until the temperature comes down and then to remove the pus tubes and to close the abdomen without drainage.

DR. PRICE: Nothing has given me more pleasure than Dr. Gibbon's reference to the concensus of opinion among surgeons today. There is, perhaps, one among them who believes it right to wait until the pathologic products gravitate to a safe point. I have never found the safe point for pathologic fluids in the peritoneal cavity. We look upon the "internal medicine" man, as he is pleased to

call himself, as a specialist and expert in diagnosis and therapeutics. There is no advance in medicine that has pleased me more than the progress of the modern clinician. I rarely look at or examine the cases I am called to operate on, but prepare for operation as soon as I enter the hospital. The rural practitioner does not err in over 1% in diagnosis. He makes a more accurate and differential diagnosis oftener than I am willing to make—I usually aim at simply an operative diagnosis. Dr. Laplace has entered into the discussion in his usual scientific way, pressing the importance of early interference in all perforative forms of disease to avoid germ or toxin virulence by culture, and Dr. Gibbon has presented the hard facts in surgery. He drains and he irrigates and he makes a very careful selection of his cases for both. In my paper I criticised the common methods of packing. Only recently a good operator in this city reopened 5 cases for obstruction. He does a gauze pack that results in bowel pressure. The gauze should be placed low down and not packed upon viscera paralyzed by peritonitis and over distention. The cases of peritonitis that I fear the most are those of enormous distention. In some cases I evacuate, by puncture of bowel, discharge gas and bowel contents, close and drain with good results. At the Toronto meeting, many years ago, Dr. Murphy made the statement that all the cases of simple appendicitis recover, but in the complicated fulminating cases in 10 or 16 hours after operation they go to the postmortem table; and the peritoneal cavity is found to be dirty and septic. After being told at that meeting how to save these cases he came to Atlantic City last summer and flourished 16 cases of recovery of the perforative form of disease. Up to the time of the Toronto meeting he had not saved one. A great many men do "dry surgery," using gauze packs. They say they get fine results, and I believe them; but they are really drainage operations for 30 minutes or for 4 hours. Simple irrigation gets rid of the exudates and filth and what is left is diluted and rendered less septic by sterile fluids and salt solutions. This is the safest and quickest procedure I am so glad that Dr. Gibbon referred to that common practice of operators of waiting for recovery from collapse or for reaction. Ether and early rapid surgery is very good treatment for shock. Put a patient on the table with a pulse of 160, the stimulus and the sting of the knife and the stimulus of hot salt solution or sterilized water in his peritoneal cavity or over his solar plexus for 10 or 15 minutes will bring his pulse down to 120, and he comes off the table in better shape than he went on, with the culture medium of Laplace gone, and the infection nipped in the bud. I am not opposing the use of salt solution; if anything, it is too good For a long time I paid over $100 a year for distilled water, while doing this at home. I was at many points throughout the country using hot tap water with just as good results. Then, I decided we would filter and boil and reboil the water and the results were fine. Then salt solution was handed to me in a number of hospitals bottled up and corked, and we had post-operative obstruction. I would reopen and had some very pretty figures of eight kinks to free, showing that this salt solution is too good. There was no infection, no air; but I just had a healthy adhesion, so I have stopped using it at home. Gauze is really one of the most valuable materials ever given to surgery; it is a drainage dressing. I have no knowledge of ever making the claim that all my cases get well, you all know better. I have operated on 26 typhoid perforations—not one a year. That is very small; does not even speak well

for the confidence my clinical colleagues have in me. Of the first 22, I lost 11, or 50%; the last 4 recovered. The absence of the hepatic zone of dulness ought not to be waited for, for this symptom only occurs in about 5% of cases. The plan outlined by Dr. Gibbon which is followed at the Pennsylvania Hospital is a good one, and even if the first meter of the ileum is inspected and no perforation found, it will do no harm. If the patient is profoundly septic or in a low typhoid condition drainage will greatly improve his symptoms and lower both temperature and pulse. I would trust the young staff at the Pennsylvania Hospital upon just a shadow of doubt as to whether there is a small opening, to open my abdomen and put in a drain. I would much rather they would clear up the diagnosis than delay 4 days until the peritoneal cavity has become the huge culture cavity of Laplace. If the saving of life be our highest office we must aim, as a working faith, at accurate knowledge, technical skill and continuous, rigid, ceremonial cleanliness, perfected by toilette and drainage.

How Can the Physician Profit by Preventive Medicine.

By J. Madison Taylor, A. B., M. D.

[Read March 8.]

Preventive medicine occupies the best attention of the brightest minds in the profession. The fear is often expressed that when the fullness of light is shed on the means of controlling and preventing disease, then the day of the general practitioner must cease; his occupation will be gone. This may be true, but that day is far distant, if ever attainable. Meanwhile it must be evident that the function of mere alleviation of human suffering is only a part, and an insignificant part, of the prerogatives of the educated medical expert. Our teachings are, in the main, on the wrong basis. Worse than this, many of the customs of the community toward us are false, misleading, unfair. A day must soon dawn, and we should hasten its coming, when we shall exert a far higher and better influence, a different amplitude of professional potential. For one thing, the prevailing custom of calling on the practitioner only to aid those actually suffering from disabilities is altogether wrong; it is based on a false concept of our duties, our prerogatives, our usefulness. Statistics of disease are being more directly reduced to the factors of economics. Tuberculosis, typhoid fever, plague, yellow fever, cholera, and all the more devastating infections are now universally studied from the standpoint of dollars and cents.

It is eminently our duty to regard the effects of preventable disease as so much loss of wage earning dynamics. We have endless

lands, mines, water powers, and other nonproductive assets, demanding competent workers to develop them. It will be a long time before we can become overcrowded with the kind of people our country produces and needs.

Assuming that the race shall continue to grow in wisdom, in capacities, in adaptabilities in the future as in the past, we need all the workers we can produce. Our legislators are ourselves. It will soon be recognized that these preventable diseases deprive us of an utterly unwarrantable proportion of our best brains and hands. This must not continue, but by what means can this emancipation be accomplished?

Clearly it is a poor, primitive, ineffective measure to wait till tuberculosis has fastened itself upon a man before we are privileged to institute measures to check it. It is a benighted land where we must drink polluted water till our best and dearest acquire typhoid fever before we are permitted to put out the hand to exterminate the destroyer at its source.

It is a poor-spirited community, those are criminal officials, who permit syphilis or smallpox to propagate unchecked under our noses whereby our beloved ones may acquire loathsome disablements at our very doors, by accidental contacts with pest breeders.

The instincts of the people alone are not enough to make them wise or providential; they will continue to patiently or stupidly endure the effects of their ignorance unless we point the way of and enforce reform. Water rises no higher than its source. The people cannot know what are the possibilities of relief, of cure, of prevention, unless we boldly define these both for them and the municipal authorities.

To be sure we appoint good men, often distinguished specialists, to posts of authority on health boards, but then we proceed to tie their hands in countless ways, not the least of which is to often grumblingly resent their so-called "interference."

This is too frequently the tone taken by the general practitioner toward the exponents of public medicine. In the past, during the prevalance of older methods, often it did seem that the health officers overstepped their authority while meeting grave exigencies (according to their lights) but it should not be so now. No adequate measures for defense for a community or a state, can be initiated or carried to practical results save by cooperation with the recognized authorities. We, of the rank and file, fighting the destroyer in the households, enjoy

limitless opportunities to offer aid and defense provided we secure full confidence and cooperation, first of each other, next of the people.

One thing, one custom is altogether wrong, viz., the giving service only for a fee. To put it better, it is a false position for the physician to earn no fee except by being invited to meet emergencies when they have arisen. Reference is often made to a supposititious custom in China that the medical man is said to be there paid to keep the household well, and is docked if members fall ill. There is no such custom in China, so Dr. Coltmann avers, nevertheless it is the only right basis on which the best medical practice can be pursued.

It may seem too utopian a scheme for realization, but why should it be? If the custom does exist in some heathen countries, and there is a firm impression abroad that it does prevail somewhere, assuredly it is a great lesson to us who claim so high a grade of enlightenment. What would become of the clergy if they were compelled to live on thank offerings alone?

Lawyers long ago realized that fees for mere service rendered could not be relied on to keep them in business. Why are we so much behind them in asserting and claiming the full value of our services? There is no comparison between the communal usefulness of the law and the far-reaching economic force of our beneficencies to the individual or the State. Why should we not demand a retaining fee of a householder, thereby giving us access to the house, to learn of his and his family's habits, hygienic precautions, to observe constitutional peculiarities, to check vital waste, and in many ways save from perils obvious enough to us, but obscure to the uninitiated? Then if disease does come, in such a shape and fashion as providence ordains and we cannot forefend, we should be paid, by agreement, for extra and special service. This plan would be the full equivalent of much life insurance. And whereas life insurance is rarely carried except by the bread-winner, by this means we could check squandering of vitality, hence money, by early recognizing and treating incipient disorders, in the wife, the children, even the servants.

Who can deny that this saving might, in the aggregate, far outweigh the resultants of all other economic measures?

Let us take counsel how the physician could best attain results. He must become an expert in the conservation and development of the bodily energies, through the principles of hygiene in all its broad compass. He must be prompt to recognize the prephenomena, the omens of disease. This is not now feasible because opportunities are

insufficient. He must become a practical psychologist and give adequate attention to psychic progress and variants, ethical peculiarities and limitations. He must become, what his training preeminently fits him for, the guide, philosopher and friend in the daily happenings. In this he stands, or should stand, on an even plane with the clergy. It will be answered that these things are done occasionally; that some physicians do act in such capacities. True, but so rarely as to be a matter for regret. This should be the recognized duty and prerogative of that most important member of the community, the family medical adviser. It may be objected that all physicians are not so constituted, or endowed, as to fulfill these requirements. Then let those who are aware of their shortcomings take up laboratory research, specialties (of which there are more than enough from which to choose), hospital positions, many more of which ought to be suitably salaried, etc. In brief, there are enough novel, and many of the same, opportunities for such in future as exist now, and others would be made possible by this official access to the heart of families. The position of the family adviser would thus, in all ways, be amplified. Better men would be demanded to fill the post, that is, men of broader, sounder qualifications, mental, moral and social. Those in whom suitable forces exist would thereby become better developed. Medical potential would reach a higher position; the one for which it is inherently fitted.

Fashion now dictates that we shall, all of us, appear well and strong. People resent being told they are ill. When they are below par they often deny it, or admit it grudgingly. Thus fatal delays often occur. The prophetic eye can often see means of defense against preventable disorders but needs opportunity for observation.

If medical men are only equipped, trained or accustomed to minister to actual disease, most of them will lack those more desirable, practical qualifications of guides in physical betterment. If there should be a highly qualified expert in physical efficiency retained by the family, whose service might be sought freely, who knew his subject practically, we would hear far less of successful charlatans. These charlatans are becoming even bolder and more successful than ever. Many are possessed of aptitudes and knowledge and methods which are as good as ours for some conditions. Our sins are partly those of omission because we lack practical knowledge which they take occasion to learn and use.

As it is the experience is too common to find the members of a family taking lessons in physical culture, Christian science, osteopathy,

facial massage *et id omne genus*, showing obvious, and perhaps justified, dissatisfaction with the quality and character of their legitimate medical advisors, for the reason that medical practice, as it is viewed by the laity, is largely a selection of a specialist for diverse ailments. Specialism is woefully overdone, it is in great part a commercial phase of our profession. The exponents are too often young men who choose their branch because of some taste, physical or mental limitation, or mere laziness; who have no real grasp of the institutes of medicine, who never fairly earned the right to speak with authority, the product of a broad, scientific probation period.

One of the most useful, practically beneficient branches of preventive medicine is the study of bodily education, or training, whereby the best inherent potentialities shall be brought to full fruition. Also when there have arisen, as is so common, deforming contractures, disabilities from disease, in short that large array of damage entirely preventable to which I have often called attention elsewhere, the knowledge how to define and remedy these and readjust the organism with accuracy, is a specialty in itself. Here is a large field little recognized, and less worked, by the practitioners of medicine, yet is one which demands the highest scientific equipment, the broadest knowledge, the clearest judgment. By means of wisely observing the members of a household it is possible to detect many organic faults or beginnings of impairment in sense organs, nerve structures, function, the incipience of degeneration in the supporting structures of the great vital organs whereby their integrity or function, or both, are imperiled. Take for example the corset-wearing woman of sedentary habits, overfed and under-exercised, who is often a mass of toneless tissues. The imagination needs no stimulus to summon up a picture of degenerated structures inviting disaster from accident, trauma or the by-effects of maladjustments inducing irregular ill-sustained pressure on delicate nonresisting structures, on kidneys, liver, and those regulative mechanisms, the ductless glands, as well as on the caliber of blood-vessels, lymph channels, nerves, etc.

Again, contemplate the picture of a man or woman of middle life who has acquired, by habitually careless postures, minor derangements of viscera. These reflected through the segments of the cord, cause damage to the skeletal structures of the upper thoracic region, resulting in malformation of the thorax, that most important basket holding delicate organs. How much can preventive medicine accomplish here? To one who has not reflected upon the matter it does not seem

significant, nor will the conditions exhibited to a casual observer presage alarm.

To one who has given thoughtful attention to the possibilities thus opened and has learned the means to correct them, a few well-directed measures looking to the repair of tone in these degenerated structures can accomplish marked results; not only the prompt prevention of further decay but possible salvation of vital organs. How can these vital organs functionate efficiently if most of the mechanical conditions under which they exist are morbid, placing them in grave peril. The keynote is to be learned through a practical knowledge of physiology. The measures indicated are to rejuvenate the tissues through bettered oxygenation, respiratory education, the systematized skillfully directed use of many long disused or ill-used muscles, especially of the shoulder girdle or pelvic girdle. No other means offers much relief. Medicines are helpless to aid; diet, climate, can do something, but hygienic measures which fail to take this muscle education into account is inadequate. How many physicians can meet this requirement out of a full, practical knowledge of the needs of the individual? Here is clearly a large province for the general practitioner to profit by the employment of his knowledge of preventive medicine. It may be said that only a narrow and unscientific field is thus indicated. Not so; it will tax the knowledge, the capacities, of most men. The burden is, when recognized, too often shifted to some nonprofessional person who can do much, but the real service is then his, not that of the physician. Many folk, perceiving the limitations of regular medicines, and alive to their own needs, seek counsel on their own responsibility of ill taught but clever physical trainers and often recover from discomforts, even derangements, which failed to secure proper medical attention and thereafter disparage medicine and vituperate the practitioner.

Again, the prevention of deformities in children offers brilliant possibilities. These may not be so numerous, but certain forms occur in any ordinarily busy practice. Unless free access be permitted to the nursery and home schoolroom many of these escape attention. Early correction is often easy and can be complete.

Most important opportunity perhaps of all viewed in the broader light of future as well as collateral effects, is that of early recognizing neuroses and psychoses. A large proportion of the incipient phenomena of these gravely damaging derangements of nerves and brain escape recognition till fully developed or till stages are reached where

instability is established and recovery impossible. The experience of the writer has been large in this department and he is acutely aware of the lack of adequate familiarity shown by the general practitioner. The cause of this is twofold. The undergraduate teachings are insufficient in amount and definiteness and few opportunities are afforded to note these abnormalities in their early stages and in the homes.

When it is considered how seriously this class of diseases bears upon economics (see article by Chas. L. Dana, *Am. Med.*, January 21, 1905) there can be no dissent from the postulate that here is an argument for preventive medicine to be freely exercised through household inspections. Assuredly mental disease is as distressing in its effects as any other form of preventable disease.

Take the minor psychoses alone; it is vitally essential that the general practitioner shall recognize and appreciate the significance, the difference between mere neuroses, serious as they are, and that type in infancy and childhood from whence grow the manias and dementia praecox. Then come the large array of indeterminate mental states called minor psychoses, various neurasthenias, hysterias, phrenasthenias, obsessions, impulsive manias and the lesser melancholias and hypochondriac states.*

Medical inspection of schools is still in its infancy. Salaries should be paid which will warrant the best young men giving much time, not only to the discovery, but the relief and care of the difficulties met. Larger powers could be safely granted to these inspectors, of course hedged about by whatever safeguards are needful. Till this is done the family physician should be invited to make home inspections regularly and thoroughly. Public opinion needs education and on physicians the impetus of the propaganda depends.

The aim of all those who are prompted by humanitarianism is to aid in checking the spread of disease. Many would welcome opportunity. It may come to each, but individual effort avails little. Cooperation can accomplish almost anything. Disease, both mental and physical, is invited by the use of narcotics; the individual suffers most from this but also the race. It is believed that more harm is wrought by narcotics disguised as drugs than in all the guises in which they are offered. The vast array of so-called tonics, bitters, invigorators broadly advertised, most of the concentrated fluid foods and many compounds which could be specified, depend for their attrac-

* See Diagnosis in Children, *Med. News*, October 17, 1904.

tiveness almost solely upon the alcohol contained. The writer elaborated this point in a paper entitled "Dangers of Drug Using Without Guidance" (*Am. Med.*, 1903). Suffice it to say, that statistics prove that immense, indeterminable devastation is being encouraged by the public press in giving prominence to the claims of conscienceless commerce which avows that certain malt extracts, brands of liquors, bitters, tonics, preparations of coca and kola, etc., are not only absolutely harmless, but salutary. These are sometimes recommended by the profession of medicine and too often endorsed by members of the clergy. It is safe to say there is scarcely a ray of truth in such claims, as truth shall be ethically defined. It is a relic of barbaric days, of the simple faith of primitive peoples, to give ready credence to the emphatic claims of makers of cunningly devised new drugs or remedies purporting to cure disease, or improve health, by the mere swallowing of them. Competent medical experts believe none of these assertions. It is known they are, with scarcely a shadow of doubt, mere commercial vaporings, based upon a shrewd confidence in human credulity, and that credulity the product of outworn beliefs.

The peril grows, not lessens, as the public learns late and imperfectly of advances in medical thought whereby one or another cureall falls into disfavor. There is always a large market for those preparations which contain alcohol and narcotic drugs of which many, and most seductive ones, are steadily pushed upon the market.

The prevention of a large and increasing proportion of maladies, the inevitable result of the undirected, unrestrained use of these vicious mixtures can be accomplished by concerted efforts on the part of the profession of medicine which alone can know the extent and character of the menace. Humanitarian associations ought, and no doubt will, supplement our endeavors. Here is a large ground wherein the practitioner of medicine can, and should, take action to his great profit, morally as well as financially. Public opinion must be educated; we are the educators. There is no escape here from the discharge of an obvious duty save by self-deception or sheer cowardice. The facts stated are known, or if they are not fully comprehended by all they are readily obtainable. There can be no question as to the duty of the physician. To him has been given the educated mind to interpret the facts and to foresee the dangers; to warn is equally his privilege and duty.

If it is asked, how is the practitioner to profit by this missionary work, it may be answered: first, that to do a plain duty, especially to

aid materially in saving bodies and souls, is in itself a high reward, one which will give satisfaction and peace in the hour of transit; in the cold twilight of life when we are about to range ourselves with the great majority; a time when the memory of good deeds done nobly sustains faith. At that time, and during many years antecedent, as the horizon of life narrows, a sense of duty honestly performed is of vastly more concrete, obvious, sense refreshing, illuminating satisfaction than the contemplation of many an acquired field added to domains, or first liens on sky-scrapers, or golden-edged bonds. However, this is a material age, as we love to tell each other when in the full tide of our acquisitiveness and reward spells money or its equivalent. We must consider then, how this work of prevention "pays."

So long as the medical profession condones, encourages or fails to raise its individual and collective voice against this heinous exploitation of concoctions purporting to be remedies for disease, cures of bodily and mental ailments, they will remain in their present inexcusable attitude of lowered power for good, inferior potential, small influence in that sphere wherein they claim to exercise special prerogatives for prevention and cure. They will continue to see stultified not their birthrights, but their acquired and acknowledged intellectual rights, for which they have labored giving their time, their strength, their best moral development freely and for only partial and inadequate rewards. It is admitted that more than ten, yes, more than twenty, times as much so-called medicine is consumed through the agency of glowing advertisements and such like means than is prescribed by physicians. This may not be in our power to change, though I for one refuse to believe it.

It is in our power, it is within our most obvious duty to boldly denounce those directly hurtful, intolerable, preparations which are merely lures to vicious appetites. It is easy to remain supine. Most of us do thus practice a conservatism which is apparently little more than a thrifty keeping of our hands from strife. By this supineness we do earn one reward, viz., a reputation for moral cowardice.

It is a simple matter to evade or ignore these agitating ethical considerations, and we may sleep well o'nights when our consciences are gradually lulled. Another generation will awaken to the plain fact that if legitimate, regular medical science and art is to attain a plane of influence and power, which is its prerogative logically and ethically, and not only so, but financially it must demand, and secure, the right to regulate and control at least all those substances and

preparations containing narcotics which are exploited as remedies for disease.

One final thought: it is admitted that professional fees are chargeable in proportion to the standing of the expert as well as his special skill in accomplishing the purpose for which he is consulted. What standing can we claim in the community when we permit a condition to prevail such as has been pointed out. Contrarywise, how much more would our advice be worth if we were the ones, the only ones, who should and could pass judgment on when and how much of every form of narcotic shall be used?

A little careful thought by physicians will develop many points more forceful perhaps than these here suggested, whereby preventive medicine, our chief aim, may be made to pay.

Since the above paper was written, the Council of Pharmacy and Chemistry of the American Medical Association has published a very important announcement, whereby they outline their intention to make full investigations as to the composition of secret nostrums and compelling the makers of proprietary preparations to submit formulas, which will exercise a powerful influence for good.

It will be found published in the *Journal of the American Medical Association* of March 4, 1905, along with editorial comment on page 718.

This is a most important movement in the right direction. It is to be hoped the members of the profession will take full cognisance and cooperate with the work.

Attention should be forcefully drawn to the tendency shown by clergymen to endorse many questionable preparations. It should be shown that such endorsements are distinctly hurtful to the standing of the medical profession, who alone are the ones to pass judgment on such matters.

The members of this committee are men of the highest standing and ability in chemistry and pharmacy, and what they advise and recommend will carry weight, not only as individuals, but as erecting standards which can not fail to be recognised by all, both the profession and the laity.

The Problem of the Treatment of Tuberculosis of the Larynx.

BY W. G. B. HARLAND, M. D.

[Read March 8.]

In discussing this problem, I shall refer briefly to some points of the natural history of the disease.

Prevalence.—It is probable that over one-fourth of all cases of well-defined lung tuberculosis present laryngeal lesions. Besides, there are cases in which other foci are not so evident.

Parts attacked.—The vocal cords, interarytenoid fold and arytenoids are the structures most often attacked, though any and every part of the larynx may be involved by the tuberculous process.

Kinds of lesions.—A congestion of the vocal cords sometimes appears early in pulmonary tuberculosis, not due to implantation of tubercle bacilli, but possibly caused by action of toxins from the lung disease acting upon vasomotor or other nerve centres. Treatment has no effect and the condition may persist indefinitely. In acute miliary tuberculosis the patient generally dies before the tubercles in the larynx have progressed very far.

Chronic forms.—(1) Superficial ulcers are caused by breaking down of superficial tubercles. They may remain unchanged for long periods if the health of the patient is good.

(2) Subepithelial infiltrations of the mucosa vary from mere thickenings to large club-like tuberculomata. They may interfere with the movements of the vocal cords, either mechanically or by causing perineuritis of nerve fibrils; hoarseness and aphonia are often produced in this way. Fungoid thickening of the interarytenoid fold is characteristic of tuberculosis. Infiltrations may remain stationary and harmless for months; if, however, they are accompanied by edema the outlook is serious, for it is often evidence of perichondritis and death of cartilage.

(3) Tuberculomata are usually of slow growth, with little tendency to ulcerate. They rarely obstruct respiration.

(4) Deep ulceration is the closing chapter in tuberculous laryngitis; it occasions pain if located where it is affected by the act of swallowing. This lesion runs a rapid and usually a fatal course, though a few cases do recover.

Diagnosis.—Satisfactory diagnosis can only be made by laryngoscopic examination. Hoarseness, aphonia and pain on swallowing are indefinite signs.

Prognosis.—This is estimated from a study of the patient as a whole—from such data as changes in weight, temperature, pulse, condition of lungs and upper air tract, etc., as well as by an inspection of the larynx.

It is likely, in most cases, that the laryngeal disease is an index to the amount, rather than a cause, of failure of health. Larynx involvement seems evidence of weakened resistance; how far it can affect health except by causing dyspnea and difficulty in swallowing is not easily estimated. Theoretically the local lesion may be supposed to cause some toxemia, to furnish bacilli for fresh infection, or affect reflexly the vasomotor system, or digestion through the superior laryngeal and vagus. These are probably not important.

Levy's (*J. Am. Med. Ass.*, September 16, 1899, p. 707) statistics indicate that patients with lesions other than deep ulceration are twice as likely to improve as those with deep ulceration itself. Of patients without involvement of epiglottis or aryepiglottic folds, three times as many improved as when these structures were involved. Taking all things into consideration, examination of the larynx is of considerable value in making a prognosis.

Summary.—In short, we have to deal with an insidious, intractable, subepithelial infection, the germs of which lie hidden in and beyond the limits of apparent disease. The local disease ordinarily represents an extension of the disease from elsewhere, and affords evidence of weakened resisting forces. Many of the forms remain harmless indefinitely if local irritation is prevented and health improves. Although ulceration, when it occurs, has little tendency to heal, it often does get well under treatment. Taking it all in all, the disease is far from hopeless.

Treatment.—Treatment is directed toward liquefying and removing secretions from the upper air tract, toward relieving congestion and lessening irritation, and toward destroying tubercle bacilli and the diseased area produced by them. Careful attention must be paid to improvement of metabolism and general health—forced feeding, fresh air, sunshine, suitable climate, dwelling, clothing, etc., and preventing fatigue.

Local measures include the use of gargles and sprays of alkaline and antiseptic liquids such as Seiler's solution and hydrogen peroxid, of the application of astringents and alteratives such as silver nitrate (2%), argyrol (30%), iodoglycerin, creasote, 5 grains, menthol 5 grains, and olive oil 1 ounce, europhen in oil, etc., of intralaryngeal injections and insufflations, and of treatment of ulcers with lactic acid, iodin-bearing powders, and formalin. Cocain, menthol, orthoform and iodoform are employed to lessen pain.

The X-rays promise to be of use in certain cases.

Upon the subject of radical local measures the profession is divided.

The first, or conservative party, states that the position and construction of the larynx render usual surgical principles inapplicable; that although infiltration and tuberculomata are localized, it is impossible to eradicate the disease by removing them, the bacilli being in the tissues and lymph channels beyond the region of visible disease, and besides there is risk of breaking down barriers erected by nature

and opening fresh regions to infection; that the body has other foci of the disease, the laryngeal infection being secondary and usually less important. It claims that the percentage of recoveries is greater without operation.

The second party is disposed to remove localized infiltrations with cutting forceps, etc., if the disease of the lung is slight and the general health good. Some advocate the use of the galvanocautery and others inject guiacol, creasote or lactic acid into the swellings. In unfavorable cases with rapid extension of disease they advise incisions to relieve tension and favor the exit of necrotic tissue; growths are to be excised, deep ulcers curetted, and if dyspnea is distressing, tracheotomy is to be performed.

The question can only be settled by statistics covering large numbers of cases, studied over a considerable period. It will be interesting to compare results of cases untreated locally with those under conservative and with those under radical local treatment. Until such statistics are at hand it will be safe to follow Sir Felix Semon's advice: Let infiltrations alone as far as surgery is concerned; curette and apply lactic acid to ulcers if single or few and involve vocal cord, ventricular band or interarytenoid fold. Ulcers on epiglottis, aryepiglottic fold or arytenoid are not so amenable to treatment.

Perhaps it is not too much to hope that by the use of antitoxic or antituberculous serum we may some day be able to add an artificial immunity to the immunity already possessed by the patient, and be able by its use to clear away the disease in the larynx as readily as the throat is cleared in diphtheria by the use of antitoxin. Studies are being made in this direction, and in some ways the outlook is very bright.

DISCUSSION.

DR. H. E. WETHERILL: I would like to ask how the X-rays are applied, whether from the outside or deep down in the throat. I don't know whether any of the members are acquainted with the laryngoscope exhibited at the St. Louis fair, in which three people could see the vocal cords at the same time.

DR. W. WAYNE BABCOCK: Several months ago I was called to see a patient in consultation with Dr. C. C. Royce who had had laryngeal tuberculosis for a number of months. On the day when I saw the patient she had received, as she had many times previously, an intralaryngeal application, which was followed by dyspnea and, finally, unconsciousness. At the time seen, the patient had been unconscious for 4 or 5 hours and was apparently nearly moribund. An immediate tracheotomy was done without removing the patient from the floor, where she had been placed She rapidly improved, gained in weight, and was able to breathe freely through the larynx. The tube was removed and the

opening rapidly cicatrized. Two or three months later she again became asphyxiated from a rapid edema of the larynx, and a second tracheotomy was done, since which time she has continuously worn a tube. Her voice is better than before and she has gained 6 pounds. I should like to ask Dr. Harland his experience after tracheotomy in cases of this type.

DR. J. MADISON TAYLOR: I have recently had sent to me for publication in the *Monthly Cyclopedia*, which I edit, an article of great interest in this connection by Dr. E. S. Bullock, of St. Joseph's Sanitarium in New Mexico, who has had an unusual experience in laryngeal tuberculosis. He speaks enthusiastically of the method he is now using which, is, in brief, the twice daily application, by swabbing, of formalin and other preparations, along with the employment of general hygienic measures. He claims that all applications in this condition are successful in proportion as they are frequently repeated, and he would prefer to make them even oftener if it were feasible.

DR. ROSS HALL SKILLERN: Although Dr. Harland failed to lay particular stress on intratracheal or intralaryngeal injections, nevertheless, I would like to refer to these methods in two cases, demonstrating the discrimination which must be used when applying either of these methods of medication. (1) Male adult, with a well-marked case of laryngeal phthisis, presenting the usual laryngoscopic image, had seizures of the most violent paroxysms of coughing, lasting for many minutes. Was relieved of these paroxysms by 4 daily intratracheal injections of a mixture of menthol, guiacol and olive oil. (2) Male adult, similar in every respect to the preceding case, with the exception of the paroxysms of coughing and the addition of great tenderness on palpation of the thyroid plates. The above treatment was exhibited with no apparent result. Intralaryngeal injections of ozonated turpine, 5 cc. daily, were then given with almost immediate disappearance of the tenderness and ultimately reducing the infiltration. Referring to surgical procedures, at the International Congress of Physicians, held in London in 1895, a heated discussion arose between the radicals and the conservatives as to the proper treatment of this disease. Such authorities as Moritz Schmidt, Gougenheim, Garel, Macyntire and others advocated from curettage to tracheotomy and even laryngectomy. From that time these radical methods appear to have fallen into more or less disuse. Magnum recently reported 75% of cures in 21 cases by the intratracheal injections of 5% ichthyol in pure cod liver oil. Harris brought out this treatment in 1896 and claimed for it good results. It seems to me that the duty of the laryngologist in the treat ment of laryngeal phthisis, is to give the greatest amount of relief possible with the smallest amount of actual manipulation of the diseased structures.

DR. L. J. HAMMOND: I would like to add that from a purely surgical standpoint, however, that there seems to be logical reasoning for surgical treatment for the relief of this admittedly hopeless condition. During the last 18 months I have operated on 8 cases in which the phthisical sufferer presented the laryngeal symptoms more pronouncedly than the pulmonary, and the great discomfort from the dyspnea and the many conditions arising from improper aeration led me to regard surgical interference as a procedure which should not be neglected. A low tracheotomy, or, more properly speaking, a tracheobronchotomy would seem to be a rational procedure, putting at rest, as it does, an edematous, ulcerated or granulated larynx, which is of itself an important step in the treatment of any

inflammatory condition, and especially when of such a low type as tuberculous infiltration. In addition, the laryngologist should be able to more satisfactorily locally treat a larynx that is practically at rest. Another valuable contribution to the relief of these sufferers is that the air admitted through the tube is uncontaminated as it surely must not be when filtered through a tuberculous larynx.

DR. G. E. PFAHLER: Dr. Harland spoke of the use of the X-rays. I have a patient, referred to me by Dr. Cleveland, who has been making the laryngologic observations, and he reports to me that the case has distinctly improved. I have been watching his general condition. The upper half of each lung was infiltrated with tuberculosis. There has been general improvement. His weight and strength have increased. I make the application externally, using a high vacuum tube at a distance of from 15 to 20 inches, in order to carry the X-rays through the chest and larynx.

DR. HARLAND: I wrote the paper with the idea of bringing out a very different point than the discussion has followed, the problem of the treatment rather than the treatment itself; to tell the general practitioner how far laryngeal trouble is innocent and how far harmful, its use in diagnosis and prognosis. In many cases the condition can be let alone if you build up the patient's health. X-rays were applied from the outside. How far that procedure does good is hard to estimate, because at the same time we are trying to build up the patient's general health. The intratracheal injection may reflexly cause trouble, but I have never seen any such results. It is difficult to estimate the value of ichthyol and other remedies because, like every other medicament, they appeal to the imagination of the patient, and anything new for a tuberculous patient always does good for a little while. In the West the good results after operations are partly due to the climate. Of 7 cases operated on by a noted laryngologist of this city, only one did well and this was operated on in Denver. The good results were ascribed to the perfect conditions under which the patient lived. Of the remedies, formalin is supposed to be the best. Gallagher has done much to exploit it. The intralaryngeal injections do good. As one speaker said, they should be employed very frequently to get the best results. The surgical treatment, so far as I have been able to see, is rather unsatisfactory. The cases that seem to need radical surgery are generally those that are going to die soon; and it seems to me a little more charitable to let them rest than to give them a day or 2 longer of suffering by performing a radical operation. Those who are most enthusiastic on the side of operations want the cases in which the laryngitis and other conditions are of the very mild kind—the cases that do well under general treatment. I agree with Dr. Pfahler that the X-ray tube should be held at a considerable distance from the patient to prevent destroying the healthy tissues.

The Osmic Acid Treatment of Tic Douloureux.

BY W. WAYNE BABCOCK, M. D.

[Read March 8.]

Despite conflicting opinions regarding the pathology of trifacial neuralgia, there is a general unanimity of opinion that relief from the tormenting pain usually is to be obtained by interruption of sensory impulses from the periphery to the trigeminal centers. In cases of the severe type so little has been accomplished by attempts to restore the normal function to the nerves, that arrest of sensory conduction is the chief method of treatment considered. That relief is almost uniformly obtained by the positive interruption of the sensory paths, suggests that pain of purely centric origin, in the forms of tic at least, is rare, and not, as a rule, to be considered in the method of treatment. The tendency toward regeneration of sensory nerves after division or partial ablation; or the resumption of their function by means of nerve anastomoses, make it difficult to permanently arrest the pain. This return of the symptoms is usually noticed within a few weeks or months after operations upon the peripheral trunks, and occasionally seems to have occurred after what is asserted to have been a complete extirpation of the ganglion of Gasser.

The evidence advanced by Spiller and Frazier to prove that regeneration never occurs after simple division of the sensory root of the ganglion, has not been entirely accepted. Experimental evidence has been brought forward to show that there may be some regeneration after division of the sensory root, and in Sherman's case it is asserted that after all of the sensory fibers of the ganglion were cut there was a return of the pain.

To the patient contemplating operative treatment, one is justified in promising some relief, usually of a temporary character, yet with trifling risk, after operations in which the peripheral nerves are divided or resected; and relief, usually complete and permanent, yet with grave operative danger, after excision of the ganglion or division of the sensory root.

Twenty-five years ago osmic acid came into use in the treatment of various forms of neuralgia. Weak solutions of the acid were injected through a hypodermic needle as close to the affected nerve as possible, and from this treatment a number of apparent cures were reported. After a more extended use, the method fell into disfavor with most surgeons, on account of its unreliability. It had been first

adopted because of the known affinity between osmic acid and certain portions of nerve substance, and we know that when in contact with a nerve, it produces a necrosis that results in what is usually a permanent destruction of the portion of nerve acted upon. With such a marked destructive action, the rarity of motor paralysis after its injection in the vicinity of mixed nerves, is to be wondered at, and indicates that the precise injection of the acid into the nerve trunk was much rarer than many operators believed.

This method is too uncertain in its technical application to permit definite conclusions to be drawn as to the value of injections of osmic acid for neuralgia. About eight years ago, W. H. Bennett began to inject from ten to fifteen minims of a one percent. solution of osmic acid directly into the nerve trunks after their exposure by a suitable incision, and obtained results that were almost uniformly favorable. Some of his cases have been relieved from trigeminal neuralgia for over four years after the use of this agent.

The method has been extended and popularized in this country by John B. Murphy, who has likewise obtained, in the majority of cases, results of the most gratifying type, and has experimentally sought to determine the precise action of osmic acid upon nerve trunks.

The efficacy of the injection seems to depend upon two factors; first, the thorough destruction of nerve filaments and adjacent tissues produced by the osmic acid; and second, the fact that the area of destruction becomes filled by a mass of scar tissue that is impermeable to sensory impulses. As to the secondary changes in the nerve trunks and ganglia, the evidence is somewhat conflicting, and need not now be discussed. In a large percentage of the cases the injection is followed by complete anesthesia and relief of the pain, which persists at least for several years. As to complete cures, a sufficient time has not yet elapsed to warrant conclusions. In another percentage of the cases, the relief is only partial or temporary, yet most of these patients are improved or relieved by a second injection of the osmic acid. From a review of the recorded cases, absence of decided improvement after the precise injection of osmic acid into the trunk of the affected nerve, seems rare, but as the treatment does not prevent the formation of new nerve anastomoses, and as the operator may fail to thoroughly inject all of the involved fibers, failures to obtain entire relief are not to be wondered at. While locally the acid produces a marked necrosis, if the superficial tissues are protected and the wound does not become infected, the injection is not followed by the formation

of an abscess. There is no danger to the general system from the local absorption of the osmic acid after the operation.

The technique of the treatment is simple, yet it must be precise. An incision is made over the affected nerve trunk. This is hooked up, taking great care to include all of its fibers, and from seven to fifteen minims of a two percent. solution (Murphy) of osmic acid injected, the introduction being made through several different punctures into the nerve. It seems wise in many cases also to inject five or ten drops of the solution into the foramina of exit of the nerve. The branches of the fifth nerve may all be reached through the mouth, except the supraorbital, so the operation is not a disfiguring one. It may be done under general or local anesthesia. The sloughing which may occur about the seat of the injection after the operation is done through the mouth, is rarely troublesome and may be of advantage, as it increases the quantity of cicatricial tissue left in the course of the affected nerve, leaving a barrier through which nerve regeneration may be difficult.

Bennett believes that the treatment should be applied early in the course of the disease, and Murphy's paper aroused some criticism as to the value of such a peripheral operation, especially in cases of long standing and of severe type. The final conclusion in the matter must rest upon the clinical results of the treatment. To contribute to the general reply to these criticisms, the following, a case of extreme severity, is submitted:

History.—W. H. M., a widower, day watchman, was born in Switzerland, 55 years ago. The family history is negative.

Previous History.—As a child his general health was good. He had whooping-cough, but did not contract measles or scarlet fever. When 7 or 8 years old his face was burned by an explosion of powder, and the resulting conjunctivitis continued for 3 or 4 years. When 15 or 16 years of age he had typhoid fever. In 1865 he came to the United States, and in 1866 enlisted in the Union Army, and while serving at Fort Churchill contracted malaria, characterized by chills and fever upon alternating days. These continued for about 18 months, but did not confine him to bed. When he had nearly recovered from malaria and while employed as a mail carrier, he had sunstroke, fell from his horse, and was unconscious for several hours. From this he became more susceptible to summer heat. He smokes in moderation, but denies addiction to stimulants, or specific disease.

Present Illness.—Began in 1870 with pain in the left cheek. This was entirely relieved by drugs. In 1871 it recurred in the left cheek, temple and side of the head, and was continuous until 1875, when it became much more severe. Medicinal treatment gave but temporary relief, but the patient was able to continue his work by taking intervals of rest from time to time. For the relief of the pain, increasing doses of narcotics were used. The pain was excruciating and resisted all medical measures. The pain was chiefly in the region of distribution of the

left infraorbital nerve. In 1886 the first operation was performed, R. J. Levis excecting a portion of the left infraorbital nerve at the Jefferson Medical College Hospital. This gave relief to the left side of the face, but a week later pain began in the region of the distribution of the right supraorbital nerve, and seemed even more severe than that previously present upon the left side, while a year later the pain again recurred in the distribution of the left supraorbital. In 1892 after 6 years of suffering, with intervals of but partial relief obtained by the use of drugs, he entered St. Mary's Hospital for resection of the right infraorbital nerve. He remained in the Hospital for 5 weeks as the consequence of an accidental burn. During this time he obtained fair relief from the neuralgic pain. Two days after leaving the Hospital, pain of excruciating severity recurred in the region of the nerve just resected. This was more sev ere than he had ever before suffered. In 1893 Dr. Garretson explored the region of the left antrum. As far as known, the nerve was not resected. The patient remained in the Hospital 7 weeks, but obtained no relief. Despairing of operative relief, the patient tried a multitude of drugs. In 1897 from an overdose of chloral hydrate, given by his physician, he became delirious and jumped through a glass window, cutting his leg. He was adjudged insane and was committed to Norristown. Relieved from the effect of drugs, his mind cleared in 4 weeks, but he was obliged to remain at Norristown until the required legal time of 3 months had expired.

In June, 1899, at the Polyclinic, the right infraorbital was resected by opening the antrum, and later nearly the entire inferior dental canal exposed and the nerve removed. For 2 weeks following the operation he suffered much pain, after which the pain ceased for 3 months, but to again recur. In September, 1899, two well-known surgeons attempted to remove the right Gasserian ganglion. Such profuse hemorrhage resulted that the operation was not finished. Two days later the operation was continued, but again the hemorrhage was so severe that the operation was finally abandoned before the ganglion was removed. The postoperative anemia was so great that the patient asserts that he was unconscious for one week following the operation, and for the ensuing 7 months was markedly asthenic. At the end of 7 months his strength began to return, and with it came the pain, which had been absent during the period of asthenia. The operation was followed by loss of vision of the right eye, attributed to retinal changes. It is to be noted that the patient has had cataracts forming in each eye since 1885, and in 1895 he had a left iridectomy followed by cataract extraction.

The pain soon became extremely severe, and it seemed as if the suffering had never been more intense, and the left supraorbital showed involvment for the first time. During the paroxysms of pain as much as 5 grains of morphin and ½ pint of whiskey were used at a single dose.

In 1902 another surgeon did 2 operations upon different days. The left infraorbital, supraorbital, inferior maxillary, and later the left and right inferior dental nerves were resected. To prevent regeneration the canals or foramina upon the left side were plugged with gold foil. The patient was in the hospital one month and had partial relief until 7 days after leaving the Hospital. He resumed his work as watchman with great difficulty, trying to secure relief from the pain, when it was at its worst, by the use of various drugs.

In June, 1904, he came under my observation. At this time the pain was

chiefly in the regions supplied by the right trifacial, but the most intense pain was in the distribution of the right inferior dental nerve. Articulation and mastication produced paroxysms of terrific pain, and he had been unable to eat solid food for 6 weeks. The man was fairly developed but poorly nourished, and his physical condition from the use of many drugs and the very small amount of nourishment taken, was bad. This was the longest attack without an intermission that he had ever had. The pain usually began in the right inferior maxillary nerve, and would then spread to the infra- and supraorbitals. The man was skeptical of all operative measures, and it was with considerable difficulty that he was persuaded to have injections of osmic acid tried. On June 16, 1904, we exposed the right inferior dental nerve from within the mouth, using cocain anesthesia. The nerve was hooked up just above its entrance into the inferior dental canal, and about 12 minims of a freshly prepared, 2 per-cent. osmic acid solution were injected into the nerve trunk. The severe pain experienced by the patient in opening his mouth, increased the operative difficulties. After the first night there was almost complete relief from the pain in all branches of the nerve upon the right side. There was some sloughing from the wound in the mouth. Since this operation the entire physical condition of the patient has greatly improved. He has gained over 35 pounds in weight. There have been attacks of pain of moderate severity from time to time in the upper branches of the nerve, but the relief has been so great that the patient did not care to have these nerves injected, until in January, 1905, when he was readmitted to the Samaritan Hospital. At this time there was a rather severe paroxysm, involving the region supplied by the right supra- and infra-orbital nerves, and the left infraorbital nerve, which apparently had been induced by exposure to severe climatic changes. Under ether both infraorbital and anterior palatine nerves were injected through incisions made from within the mouth. Bits of loose gold foil were removed about the left infraorbital foramen. The supraorbital nerve was injected through an incision under the eyebrow. The isolation of the infraorbitals was rendered more uncertain by the results of former operations, and as the anesthesia in the areas supplied by these nerves is not complete, it is believed that either certain fibers were missed, or that there were anastomoses of adjacent nerves.

The patient has been markedly relieved, however, and while he now complains of some dull aching pain in the face, which is also present in other portions of the body, the lancinating neuralgic pain is absent. Complete anesthesia remains in the area of distribution of the inferior dental nerve, which previously was hyperesthetic If the pain should again return we should consider an injection of the deeper branches.

For the present, or until the value of osmic acid injections in tic douloureux is disproved, it seems that one is as justified in advocating an operation upon the Gassarian ganglion without a consideration of this minor procedure as in considering Caesarian section in dystocia, irrespective of less dangerous methods of delivery. It is to be expected, however, that operation upon the ganglion will still have an important

place in surgery, serving in cases in which all minor methods are inapplicable. It is evident also that this major operation of excision of the ganglion may fail in certain rare cases.

Exhibition of Instruments.

BY H. E. WETHERILL, M. D.

[March 8.]

Dr. WETHERILL called attention to his improved hemoglobin scale, and color test book for the better determination of hemoglobin moisture, perspiration, urine colors and the color of the feces. The postmortem blood colors are of advantage in giving a better description of the blood at necropsy. The color scale for measuring the weight of the perspiration is used with a cobalt chlorid disc and gives the amount of moisture over an area of ¾ inch in diameter. A relative humidity instrument for measuring cutaneous moisture in uremia and fevers was shown, and said to be very useful generally. The color scale for the feces gives the colors of the feces in different diseases, and the table describes the numbers, colors and diseases.

He also showed a new hematokrit which measures by a two-way motion instead of one, and gives 25,000 revolutions per minute. He spoke of the 40 cc. form for urine, chemic and pharmaceutic precipitates.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

Cerebrospinal Fever (Epidemic Cerebrospinal Meningitis).

By J. C. Wilson, M. D.

The preliminary work of Weichselbaum (1887) and Jäger (1895) and the definitive report of Councilman, Mallory and Wright (1897) have demonstrated the exciting cause of this specific form of cerebrospinal meningitis to be the diplococcus intracellularis meningitidis. A few days ago, Councilman (*J. Am. Med. Ass.*, April 1, 1905), published a most important contribution to the bacteriology and pathology of the subject, in which a brilliant sidelight is thrown upon the obscurities of the disease in certain of its epidemiologic and clinical aspects.

Much has been done to clear up the obscurities regarding the origin and nature of cerebrospinal fever, but much remains to be done, especially with reference to the cases that are not well characterized and in the direction of treatment. The subject acquires a peculiar interest at this time on account of the epidemic which has prevailed in New York City since February, 1904, resulting in more than 1,000 deaths, the number recently reaching 130 deaths per week; and the evidences of its tendency to spread in Philadelphia since the localized outbreak of twenty-three cases which occurred at the United States Navy Yard at League Island in the spring of 1904. At the present time there are three cases in the medical service of the Pennsylvania Hospital. It is also reported that the disease has assumed an epidemic form in some parts of Europe, especially in Silesia.

Cerebrospinal fever may be defined as an acute, infectious, epidemic disease caused by the diplococcus intracellularis meningitidis, characterized, clinically, by sudden onset with headache, vomiting and painful contraction of the muscles of the back of the neck, irregular

fever, profound nervous symptoms, rapid course and high death rate; anatomically, by inflammation of the meninges of the brain and cord.

This disease was first recognized as a distinct affection about the beginning of the nineteenth century.

Climate appears to have little influence as a predisposing factor. Outbreaks are more common and extensive in the winter and spring than in the warm seasons of the year. Densely populated cities and sparsely settled agricultural regions are alike subject to its prevalence. In adult life the proportion of males attacked is greater than that of females. Among children the number of males and females is about equal. Cerebrospinal fever is especially a disease of children and young adults. After forty it is uncommon, though the diagnosis has been verified postmortem in individuals over seventy. Individuals of all occupations and professions are liable to this disease. Military life involves a special liability.

Cerebrospinal fever does not appear to be contagious in the sense in which we are in the habit of using the term in speaking of smallpox, scarlet fever and typhus. Councilman in his first report states that the evidence on the whole is not conclusive that the disease is incapable of being transmitted from one individual to another. The definite microorganism which causes it is in the majority of instances confined to the meninges of the brain and cord, with little or no opportunity of transmission to other individuals. In cases in which there are lesions in the lungs, ears and nose, however, infection of neighboring objects or persons may readily take place. It is important at this point to note the following statement of Councilman in the recent contribution to the subject above referred to: "The presence of (these) sporadic cases is of importance in the occurrence of epidemics. The diplococcus intracellularis is an organism of feeble vitality; it dies out easily on exposure to drying and light and is incapable of a saprophytic existence. In the absence of intervening infections, it would be impossible for the period of epidemics to be bridged over. Not only this, but there is evidence that this organism can produce other infections and may even live as an inhabitant on the normal mucous membrane."

The older literature contains numerous accounts which suggest the possibility of the specific exciting cause of this disease being communicable from one person to another or at least portable on the person or among the effects of those who have been exposed to it. Many of these relate to the outbreaks among French troops and are highly suggestive.

The following personal observation is not without interest:

I saw at 8 o'clock in the evening of March 13, 1905, in consultation with a medical colleague, a physician, aged 33 years, suffering from fulminant cerebrospinal fever, the first symptoms of which had appeared upon the previous evening and which terminated fatally during the course of the night in a little more than 24 hours from the onset. This gentleman had been in constant attendance upon a patient who had died of malignant cerebrospinal fever of two days' duration about 12 hours before his own sickness began.

In view of the foregoing fact it cannot be affirmed that cerebrospinal fever is not, under certain circumstances, a transmissible disease. Second attacks are exceedingly rare.

The pathogenic organism is found in the fluid obtained by lumbar puncture and in the meningeal exudate. The cerebrospinal fluid is usually more or less turbid, sometimes quite so especially early in the course of the attack. In a chronic case under the care of my colleague, Dr. Lewis, in the Pennsylvania Hospital, the fluid was turbid when first withdrawn, but perfectly clear upon a second puncture made forty-three days later, although the symptoms persisted. In one of my own cases in which the duration of the illness could not be determined and the patient, prior to his admission to the hospital, was supposed to be suffering from uremia, the fluid was perfectly limpid, but showed pure culture of the diplococcus intracellularis meningitidis.

While turbidity of the spinal fluid is of diagnostic importance, its limpidity does not constitute a negative sign, and in either case cultures are necessary to the diagnosis.

Cerebrospinal fever presents a great diversity of symptoms in different cases. No other acute disease appears in such various guises. Stillé has well called it a "chameleon-like disorder." The period of incubation is unknown. Prodromes are rare. When present they consist of headache, dragging muscular pains, vertigo and a sense of fatigue. The onset of the attack is usually abrupt. It is marked by a chill, agonizing headache, nausea and vomiting. In some cases headache is not a conspicuous symptom. The attack begins with vertigo and the patient acts like a drunken man. This was the mode of onset in a case which I recently had the opportunity of seeing. Presently dragging pains in the neck come on which spread along the spine and into the extremities and are soon followed by motor symptoms which progressively develop. These consist of tetanic stiffness

of the spinal muscles, great pain on attempting to bend the head forward or turn it from side to side and awkwardness and difficulty in movements of the extremities. Strabismus, inequality of the pupils and palsies of the facial muscles are common. In the course of a little time opisthotonos develops, the head is drawn back, the spine curved, the forearms flexed upon the arms and the legs upon the thighs. Muscular cramps and spasmodic twitchings come and go. In young children general convulsions may occur.

Hemiplegia has been frequently observed. Paraplegia may also occur. Paralysis may develop during the course of the attack and disappear shortly or it may persist for some time.

The sensory symptoms consist of headache, pain in the back of the neck and in the lumbar and epigastric regions and general hyperesthesia, most marked in the face and neck. Various disturbances of the special senses occur. There is photophobia, intolerance of sounds, ringing in the ears and vertigo.

The psychical disturbances are striking. The patient is restless and distressed. His face is seldom flushed, usually pale and slightly cyanotic. In children there is great irritability. Delirium occurs early and may be active, even maniacal or of a busy wandering character. After a time it passes into somnolence or stupor which may be still attended by more or less restlessness and continual movement upon the bed. In the worst cases stupor deepens to coma.

The symptoms referable to the alimentary tract are not characteristic. The tongue is at first lightly covered with a whitish fur. Taste is lost and the patient refuses food; nevertheless the vomiting persists. Constipation is commonly present throughout the sickness. Toward the end of the attack, however, diarrhea and involuntary discharges may take place. Slight, exceptionally marked, enlargement of the spleen may be made out.

The fever is generally moderate, very irregular and does not follow a typical course. There are frequent remissions. In some instances fever is slight or absent altogether. On the other hand, the temperature may reach 105° to 106° F. In some cases it abruptly rises before death. The fever even when intense may be of short duration. There is no constant relation between the intensity of the febrile movement and the severity of the other symptoms.

The pulse is also irregular. It may be soft and weak, even slower than in health, and is often intermittent and arrhythmic. There is no constant correspondence between the pulse and the temperature. The

rhythm of the respiration may be disturbed and Cheyne-Stokes breathing may occur in the graver cases.

Leukocytosis is present throughout the disease, diminishing toward the end of the attack in cases which recover. In thirty-three cases in the Boston epidemic in which blood counts were made the maximum number of leukocytes was 31,000, the minimum 9,350. In a case under my observation at the present time there is a leukocytosis of 40,000. Differential counts show that the increase is chiefly due to the polymorphonuclear leukocytes.

Lesions of the skin are common. To their prominence is due the old name of spotted fever. They vary greatly in different epidemics. In many cases they are absent altogether. They are polymorphous and several different forms may occur in the same case. Herpes is far more common than any other eruption. A petechial rash is frequently observed and in some instances extensive hemorrhagic areas develop in the skin. The petechiæ often resemble flea-bites. They are distributed in varying numbers over the whole surface, but particularly about the knees and elbows. Patches of erythema, dusky mottlings and rose spots disappearing on pressure, like the rash of enteric fever, have been observed.

The urine is, as a rule, increased. It may be much increased even with high temperature. The reaction is usually acid. A moderate amount of albumin is frequently present. Recent personal observations lead me to believe that there is a special form of cerebrospinal fever characterized by symptoms of an acute nephritis and corresponding to the renal form of enteric fever; the nephrotyphus of the French. I have seen two such cases in which the urine from the onset was densely albuminous, of high specific gravity and contained epithelial and blood casts and free blood. Glycosuria occasionally occurs and in malignant cases hematuria has been observed. Retention of urine is common in the graver cases. Polyuria is frequent in children and in some cases has persisted for years after convalescence.

The eye lesions are referable to three causes. First, neuritis, due to the involvment of the nerve in the exudate at the base without extension of the inflammatory process to either the orbit or the eye. This condition may affect the oculomotor and the optic nerve. Second, inflammation from the meninges may extend directly into the eye along the piaarachnoid of the optic nerve, causing purulent choroidoiritis and in very rare instances suppuration in the orbit. Keratitis may arise in consequence of an extension of the inflammation from

the iris and ciliary region. The third cause is neuritis of the fifth nerve with destruction of the Gasserian ganglion and loss of sensation.

Symptoms relating to the auditory apparatus are very common. The auditory nerve is generally swollen and surrounded by the exudate. Extensive degeneration of the nerve fibers is frequently found, the degeneration being most marked in the chronic cases.

The subject has been especially studied by Moos, who found that of sixty-four cases of meningitis which recovered, 59 per cent. of the patients were deaf, in 7 per cent. the hearing was impaired and in 31 per cent. it remained normal. Deafness is frequently due to disease of the labyrinth. Otitis media and mastoid disease occur. The diplococci are found in the pus cells.

Coryza has been frequently observed early in the course of the attack. Weigert first advanced the opinion that in meningitis the nose forms the portal of entry for the infectious organisms. It may be, however, that their presence is due to an extension from the brain and not to primary invasion. Epistaxis occurs also. In fifteen of the Boston cases ten showed the presence of the diplococci in the nasal secretion and in eighteen cases examined by Scherrer the diplococci were found in the pus cells.

The wasting in severe cases is rapid and extreme. An early, sudden and great loss of strength is a frequent and prominent condition in this disease.

The symptoms may be divided into those due to the inflammatory lesions of the cerebrospinal organs and those due to general infection. In the malignant cases both these groups of symptoms are of overwhelming severity. In the mild cases the nervous symptoms are predominant. The foregoing symptoms indicate the nature and severity of the disease in its ordinary form.

ANOMALOUS FORMS.—(1) MALIGNANT.—*Meningitis cerebrospinalis epidemica siderans.* The patient is struck down without warning and speedily falls into a state of collapse. There may be contraction of the neck. Respiration is slow and labored; the pulse rapid and feeble; the urine scanty and loaded with albumin. Purpuric blotches appear upon the surface. Cases of this kind have occurred in many epidemics and with greatest frequency at the beginning of the outbreak. They may occur sporadically. Death may ensue in the course of a few hours.

(2) ABORTIVE.—*Meningitis cerebrospinalis epidemica abortiva.* The onset of the attack is severe. In the course of a few days the

symptoms subside and convalescence is rapid. Under this head must be included the mildest ambulant cases. Cases of this kind can only be recognized in the light of a prevailing epidemic.

(3) INTERMITTENT.—*Meningitis cerebrospinalis epidemica intermittens.* Intermittent and remittent cases are common. Not only the fever but other symptoms of the disease show extraordinary exacerbations and remissions, which may be repeated at intervals of twenty-four or forty-eight hours.

(4) CHRONIC.—*Meningitis cerebrospinalis epidemica chronica.* Cases of this form occur in all epidemics. The disease lasts with numerous complications, remissions and exacerbations for several weeks or in some instances for five or six months. Emaciation is extreme.

Among the complications and sequels are pleurisy, endocarditis and pericarditis. Bronchial catarrh and deglutition pneumonia are very common. Croupous pneumonia has been common in some of the epidemics. Arthritis, commonly slight, but in rare instances suppurative, has been noted. The wrist joints are most commonly involved. I have observed transient, painful swelling, usually involving the wrists or knees, in a number of cases.

The convalescence is irregular and uncertain. After severe cases it is apt to be tardy. Relapses are not uncommon and are often fatal.

Among the more important sequels are prolonged debility and emaciation, palsies and various forms of paralysis, impairment of intelligence in consequence of chronic meningitis and chronic hydrocephalus, especially in children, and more or less complete deafness and loss of vision. General motor weakness and paralysis of individual cranial nerves or of the lower extremities may persist for a long time. They depend upon lesions of the brain or spinal cord or pressure exerted by extensive organized inflammatory exudate, or upon peripheral neuritis.

The direct diagnosis of cerebrospinal fever by ordinary clinical methods is a matter of difficulty in sporadic cases and at the beginning of outbreaks. The diagnosis of any form of meningitis is occasionally obscure. Sudden onset, chill, fever, vomiting, delirium, tremor and painful rigidity of the back of the neck may occur in pneumonia, the malignant form of variola, typhus and especially in the cerebrospinal form of enteric fever. The phenomenon described by Kernig, in 1884, and known as Kernig's sign is found to be present in 80 per cent. to 90 per cent. of the cases of meningitis and only exceptionally

present in other cases. This test is often attended by evident pain on the part of the patient. Kernig's sign is not available in cases of rheumatic or other forms of arthritis of the knee or hip, myositis, contractions from nervous disease and sciatica.

If meningitis be present there is usually no great difficulty in recognizing cerebrospinal fever during an epidemic. The ordinary and anomalous forms alike show a symptom-complex that in the course of a little time is distinctive. In doubtful cases, and indeed in all cases when practicable, lumbar puncture should be performed. The method is easy and has been shown by experience to be devoid of danger. If carried out early in the attack, at the time when the diagnosis is often as important as it is difficult, the result is commonly conclusive.

If the patient has meningitis the fluid withdrawn is, as a rule, but not invariably, more or less cloudy; if cerebrospinal fever, the diplococcus intracellularis meningitidis (meningococcus) will be found upon direct microscopic examination or in cultures. Positive conclusions can only be drawn from positive results. When the result is negative the operation must be repeated.

The differential diagnosis between cerebrospinal fever and the following diseases demands consideration:

(1) PNEUMOCOCCUS MENINGITIS.—This may occur alone or in connection with croupous pneumonia. The pulmonary lesion may be latent. In fact until recently this organism was very generally regarded as the cause of epidemic cerebrospinal fever. Symptoms indicating extensive infection of the meninges, of the cord and spinal roots and extension of the infective process along the cranial nerves are less marked or absent altogether. Contraction of the muscles of the neck may be absent, delirium and coma are present and occur early and this form of meningitis is commonly fatal, while cases of the epidemic form may recover.

(2) STREPTOCOCCUS MENINGITIS.—This form is secondary to infection elsewhere. Opisthotonus is neither common nor well-developed. The symptoms develop slowly and are often for a time obscure. The association of painful rigidity, intense headache and vomiting is not conspicuous. Eye symptoms are common.

(3) TUBERCULOUS MENINGITIS.—This form of meningitis is to be distinguished from cerebrospinal fever by a protracted period of prodromes, more gradual onset, slower course, slow and irregular pulse, great irregularity of the respiration and the absence of eruption.

Antecedent tuberculous disease, failure of health following measles or influenza, tuberculous glands or a hereditary predisposition to tuberculous infection are found in the history of the patient. In children or during the prevalence of an epidemic of cerebrospinal fever and in cases in which the tuberculous process involves the spinal meninges (Hirsch) the diagnosis is far from easy.

(4) THE CEREBROSPINAL FORM OF ENTERIC FEVER.—The onset is sudden and the symptoms of the period of invasion are those of cerebrospinal fever. About the end of the first week the cerebrospinal phenomena usually subside more or less abruptly and the subsequent course of the illness is that of an ordinary case of enteric fever.

(5) SCARLET FEVER.—In some instances the sudden onset, high febrile movement, vomiting, convulsions and stupor suggest cerebrospinal fever as it occurs in children. In the course of twenty-four or thirty-six hours the efflorescence will clear up any uncertainty.

(6) TYPHUS FEVER.—At one time cerebrospinal fever was confounded with typhus or regarded as a variety of that disease. To Stillé is due the credit of having finally settled every question of doubt concerning the identity of these two diseases in this country. They are in strong contrast in respect of their causes, symptoms, course, lesions and sequels.

(7) HYSTERIA.—Cases of cerebrospinal fever occurring in nervous females at the close of epidemics or sporadically have presented a delirium so peculiar and an array of symptoms so little characteristic that they have been looked upon as manifestations of hysteria. This error in diagnosis is no longer possible.

In individual cases the prognosis can never be made with certainty. The abortive and fulminant cases run the most rapid course. Hirsch has emphasized the fact that certain cases which at the onset present the symptoms of cerebrospinal fever recover after an illness of a few hours, which terminates in free sweating. The malignant cases, on the other hand, prove fatal in a few hours or two or three days. Moderately severe cases may last one or two weeks or several months. The first week is the time of greatest danger. Symptoms rendering the prognosis unfavorable are intense excitement, early depression, persistent vomiting, irregular respiration and convulsions alternating with coma. The average mortality is about 40 per cent. It varies in different epidemics from 20 per cent. to 75 per cent. The mortality in the Boston outbreak was 68 per cent.

Relapses are not infrequent and are often fatal.

In times of epidemics cleanliness of dwellings and the avoidance of overcrowding should be instituted in the hope of diminishing the severity and mortality of the disease. The successive attack of different members of a household demands the abandonment of the dwelling and thorough disinfection. Isolation of the patients and sterilization of their clothing should be carried out.

The mildest cases require no treatment; the malignant cases react to none. Medicine with all its resources is neither capable of combatting the attack nor responsible for its results. Of this group of cases Stillé has said, "The first symptoms of the disease are the first phenomena of death."

The room occupied by the patient should be darkened and quiet. The diet should consist of milk, eggs, meat juice and broths administered at regular intervals. When food cannot be taken by the mouth nutritious enemata should be given. Water should be freely administered. Alcohol is to be given when the symptoms of depression appear whether at the onset of the attack or later. A guide as to its amount is the effect upon the character of the pulse and the first sound of the heart. Venesection, generally practiced in the early history of the disease, is in no case admissible. In robust individuals wet cups may be applied to the nape of the neck and along the spine or leeches to the temples in the neighborhood of the mastoid process. The continuous direct application of cold to the head and spine by means of ice-bags is of value. The pain is relieved and in some instances quietude and sleep ensue. If the temperature be high systematic cold bathing may be practiced. During the application of cold to the head and spine and after cold bathing the patient should be covered with warm blankets and artificial heat applied to his sides, thighs and extremities. Warm baths, 104° F., of ten minutes' duration, have been recommended. Blisters applied to the occiput and nape of the neck early in the attack have appeared to be of service. They should be carefully watched and immediately removed upon the development of signs of vesication, which is liable to be followed by troublesome sloughing. The thermocautery may be used.

Laxative doses of calomel should be given early in the attack. Quinin has been extensively employed. There is no evidence that it exerts a favorable influence, much less that it is capable of aborting the disease. Opium may be regarded as one of the indispensable remedies in the treatment of epidemic meningitis. The indications for its use are to be found in the headache and spinal pains, restless-

ness, spasm, hyperesthesia and sleeplessness. It should be given early and in full doses. Experience has demonstrated a remarkable tolerance for this drug in cases of cerebrospinal fever. Strong gave in one case sixty drops of laudanum every half hour until half a fluid ounce was taken. Some of the early American physicians gave enormous doses, half an ounce of the tincture of opium or from thirty to sixty grains of the crude drug in the course of twelve hours. These large doses were frequently followed by recovery. Stillé gave one grain every hour in grave cases and every two hours in moderately severe cases without even an approach to narcotism. He adds that, "Under the influence of the medicine the pain and spasms subsided, the skin grew warmer and the pulse fuller, and the entire condition of the patient more hopeful." Morphin may be administered hypodermically in doses of from one-sixteenth to one-half grain. With great restlessness and jactitation hyoscin hydrobromate is indicated. In children the dose must be cautiously regulated.

Ergot, belladonna, cannabis indica, gelsemium, chloral, zinc oxid and the bromids are of inferior value. They are frequently, however, given in connection with opium or morphin. Inhalations of ether or chloroform may be cautiously employed to secure temporary relief from torturing pain, jactitation and spasm. Veratrum viride and aconite are mentioned only to condemn their use in this disease. The modern analgesics may be employed alone or in conjunction with opium and its derivatives in the management of the milder cases of the disease. Large doses are to be avoided.

If the headache and pains increase cerebrospinal fluid may be withdrawn by lumbar puncture in order to diminish the intracranial pressure. Performed early in the course of the disease and repeated at intervals it has been frequently followed by beneficial results.

Manges has reported three successful cases treated by the injection of lysol in one per cent. solution into the spinal canal after the removal of the exudate. This method was originally suggested by Carlos Franca, of Lisbon, in 1903. Wolff, of Hartford, Conn., basing the procedure upon an antagonism which he found to exist between the diplococcus intracellularis and the Klebs-Löffler bacillus and the fact that the former were precipitated from active bouillon cultures upon admixture with diphtheria antitoxic serum, was led to use the antitoxin in the treatment of this disease with satisfactory results, and Waitzfelder (*Med Rec.*, March 11, 1905,) treated seventeen cases in the same manner, employing from 4,000 to 10,000 units,

according to the age of the patient and the severity of the symptoms, at intervals of two or three days. Of the seventeen cases, five recovered completely, three died and nine were still under observation at the time of the publication of the report, five of the last "giving promise of speedy recovery." These observations are now being extensively repeated. In two cases of which I have knowledge, the antitoxin treatment was employed without result, but these two cases were of fulminant type, one dying at the end of forty-eight hours and the other in a little more than twenty-four hours.

During a period of depression stimulants are to be freely given. Preparations of alcohol, ammonium carbonate and the spirit of chloroform are recommended. Cold effusion may be occasionally practiced.

During convalescence the bitter tonics and iron may be given. Cod liver oil and potassium iodid are also employed. Delirium, spasm and irritability of the stomach too often in the severe cases render the administration of medicine and food impracticable. As recovery takes place the appetite is often excellent and an abundant, easily digested and nutritious diet of mixed solid food should be given.

DISCUSSION.

DR. JAMES TYSON: My own experience this winter has been confined to a few cases seen at the Pennsylvania Hospital in the wards of my colleagues. For the last 10 or 12 years I have seen one or more cases in consultation nearly each winter, and winter before last I saw with Dr. Griffith 8 cases in one household. My memory goes back, however, to the epidemic of 1864-67 upon which Dr. Stillé's classic paper was based and I remember particularly the case of Dr. Thomas, a very well known physician, a professor of materia medica in the College of Pharmacy and author of reputation. He was taken ill in the morning with signs of cerebrospinal meningitis and died in the evening. There were a number of such cases. It is a tradition that that epidemic of cerebrospinal meningitis which occurred during the War of Rebellion was introduced by returning soldiers, and there was also a popular belief that the cause lay in mouldy hay. Since then cerebrospinal fever has never disappeared from Philadelphia. Each winter since then there have been a few cases and this winter they have been more numerous. Examination of the meteorologic conditions for the years 1864 and 1865 shows a remarkable correspondence between the temperature of that winter and the winter which has just passed, as will be seen from the appended extract from the temperature records of the Pennsylvania Hospital:

	November.	December.	January.	February.	March.
1864-65	45.80	36.77	26.78	32.59	47.94
1904-05	44.57	32.61	31.87	29.36	44.26

The most important question is that of contagiousness. There is no doubt but that the specific bacillus has been found, but how it originates and how it is transmitted is not determined. While Dr. Wilson has deduced some of the most remarkable cases apparently dependent one upon another, I recall Dr. Abbott's paper before the Philosophical Society the other evening, in which he pointed out that in the present epidemic the cases were largely isolated, and occurred one after the other in the most remote districts. Yet I do not think we can escape the conclusion that the disease is to a certain extent contagious, and that precautions growing out of this knowledge should be taken. On the other hand, the disease is not virulently contagious, perhaps it is comparable to typhoid fever in this respect, though in certain epidemics there is greater virulence. I should like to refer to my experience in a single case with the subaqueous treatment of Goldscheider, when there was almost total paralysis as a sequel of cerebrospinal fever. The patient could not carry his hand to his mouth or move his legs. The treatment in conjunction with massage resulted in almost complete recovery. The idea is to place the patient in a bath of warm water at a comfortable temperature and to encourage voluntary motion. The movements are not passive, but active and voluntary. Improvement was rapid and marked.

DR. A. C. ABBOTT: There are only two phases of this subject on which I feel at all competent to speak; namely, the etiologic and the epidemiologic. Upon the etiologic phase of epidemic cerebrospinal meningitis, I do not think we can pronounce the final word. I have followed the investigations along this line and while I regard the contributions from Councilman's laboratory as by far the most important, yet there is no doubt that cases are occasionally encountered during epidemic times that are clinically indistinguishable from the prevailing type of the disease, but are yet due to causative factors other than the organism regarded by Councilman as specific for this malady. There appears to be a pneumococcus meningitis which can be distinguished from the epidemic type only through lumbar puncture, or at autopsy. We have also records of distinct types of meningitis secondary to typhoid fever, influenza, pneumonia and bubonic plague. What the real natures of these cases are it is hard to say, for few of them have come to autopsy, or have been carefully studied by the method of lumbar puncture, but it would seem probable that they are manifestations of a meningeal infection due to the organisms that excite those diseases. It is becoming a prevalent opinion that, as in the case of pneumonia, certain individuals in health harbor the organism that we regard as the most common cause of epidemic meningitis. We know that that organism has been found in certain local infective processes of the nasal mucous membrane and of the bronchi. It would look as if the widespread occurrence of the disease might be due to autoinfection; autoinfection that is induced by some undetermined epidemiologic factor, just as we see pneumonia occasionally assuming epidemic proportions. What that factor is we do not know.

As to the Transmissibility of the Disease.—The disease has always been regarded as more or less contagious, and by some as very contagious.

All of the records that I have consulted lead me to think that if the disease is transmissible at all, it is very mildly so, and our present experiences in Philadelphia offer nothing contrary to this view. In speaking upon this subject at the Philosophical Society last week, I exhibited a chart showing the successive incidences of the cases. The first recorded case occurred in the northeastern secton of the city. The next, miles away, in West Philadelphia. The next, far north in the Thirty-third Ward. The next in the southern part of the city, and so they have continued. Up to the time of leaving my office this afternoon, there had been reported for the present epidemic, if we may so dignify it, since September, 1904, 58 cases of cerebrospinal meningitis, with 18 deaths, a mortality of 31%; this is not allowing for any erroneous diagnoses or doubtful cases. I have succeeded in getting together 34 clinical histories. Of these 34 cases, 6 are of such a doubtful nature that it is difficult to say whether or not they were meningitis at all. Five were tuberculous and 2 were shown by lumbar puncture to have been due to the pneumococcus, so that out of the 34 cases we have 13 which may with reason be deducted from the total 58. That there are more that might be deducted, I have no doubt. The maximum number of cases reported on a single day was 6. In only 4 instances did we find more than one case to a house. In each of these four houses there were 2 cases. In 2 of the houses the cases occurred simultaneously, while from the third house there was an interval of 3 days, and in the fourth, an interval of 6 days between the days on which the cases from these houses were reported; so that in the last 2 houses it is possible for the occurrence of a transmission from one individual to another. This, barring the lamentable experience of our brother practitioner, is the only evidence that we have had of the transmission of the disease. I do not maintain that the disease is not transmissible, but I do feel that its transmission from individual to individual is of comparatively rare occurrence.

DR. W. T. LONGCOPE: During the last 2 years 18 spinal fluids from cases of acute meningitis were studied bacteriologically in the Pennsylvania Hospital. In 4 of these pneumococcus was found and in 12 the meningococcus. Cases of tuberculous meningitis have been excluded. The spinal fluid from 8 of these showed tubercle bacilli. In one of the cases of cerebrospinal fever the meningococcus was found in the spinal fluid on the third day of the disease, and again on the forty-sixth day by Dr. Robinson. In 585 autopsies there were 24 cases of acute meningitis and 15 of tuberculous meningitis. Six of the acute infections were due to either the streptococcus or staphylococcus, and were secondary to scalp wounds, otitis media or fractures of the skull. Six were due to the pneumococcus and all were secondary infections. Three were secondary to acute endocarditis; 2 to otitis media and one to infection of the nasal sinuses. There were 6 cases of meningitis due to the meningococcus. One of these was a chronic case in which there was a high grade of hydrocephalus. Dr. Wilson has spoken of the presence of the organism in the nasal discharges of patients suffering from cerebrospinal fever and also in the nasal secretions of normal individuals. The conjunctiva may also form a focus from which the organism may be distributed. In one of the cases at the Pennsylvania

Hospital there was severe purulent conjunctivitis. From the pus Dr. Robinson isolated the meningococcus. The case came to autopsy; the lesions were typical of acute meningitis, and the organism was cultivated from the cerebral exudate. I need not refer to the work recently done on the agglutination of the meningococcus by the serum of patients suffering from the disease. Two or three investigators have reported satisfactory results either with the serum of patients or of animals immunized against the meningococcus. Agglutination may occur in dilution varying from 1 to 10 to 1 to 300. I do not believe the procedure has been generally put into practice as a means of diagnosis.

DR. FRANK WOODBURY: In connection with the unfortunate case of the physician mentioned in Dr. Wilson's paper, in which the disease appeared to be communicated from a patient, I belive that the conclusion drawn, *i. e.*, that the disease is decidedly contagious, is scarcely warranted by general experience. While a resident in the wards of the Pennsylvania Hospital, during the epidemic of 1873, I had a personal experience to which I may refer in this connection. The cases were all treated in the open wards, and every day patients were examined physically for the condition of the heart and other organs, and I made a number of autopsies. Although thus freely exposed to possible contagion, not a single case arose in the hospital among the attendants, or the other patients. I think that experience, therefore, fully warrants the statement of Dr. Abbott as to the very mild degree of contagiousness of this disease. Our mortality at the time, I think, was larger than during the present epidemic, on account of recent advances in our knowledge of the nature of the disease and more rational methods. In the admirable treatment which Dr. Wilson has outlined, I noticed that he mentioned the importance of securing comparative darkness of the room, the particular object being to exclude the actinic rays of light. Professor Claudio Ferni (*Gaz. delle Ospidale et delle Cliniche*, quoted by Woodruff) called attention to the fact of exposure to direct rays of the sun being a powerful agent in predisposing an individual to cerebrospinal fever. He also found that among healthy persons exposed to the direct rays of the sun in Italy, during April and May, 83% suffered from headaches, inflammations of the mucous membranes, conjunctivitis, tonsillitis, coryza and various other affections. This has a direct relation to the point insisted upon by Major Charles E. Woodruff, surgeon United States army, in a recent work on the "Effects of Tropical Light on White Men" (New York, 1905, page 110), that all the infectious diseases make the skin more susceptible to the injurious effect of the actinic rays. He advances arguments to support the view that the skin eruptions in infectious diseases generally, are not caused directly by the germs of the disease or by the toxins, but by the action of these toxins in lowering the defence of the skin against the actinic rays of light which is the efficient agent in producing these eruptions. Therefore, the clinical precaution is warranted to treat these patients with a subdued light, either with comparative darkness or only with red light. In regard to diagnosis, it may be well to remember that the finding of the meningococcus by lumbar puncture is not conclusive evidence of the existence of cerebrospinal fever. We can find it in the

sporadic cases of spinal meningitis and it has been found in typical acute anterior poliomyelitis by Schultze (*Münch. med. Woch.*, 1899). In our treatment I think that we should not direct too much attention to the lesion in the nerve centres, brain and spinal cord and meninges, nor overlook the fact that the disease is preeminently and primarily a blood infection. Before it attacks the meninges or the nerve centres, the meningococcus must be present in the blood, and the gravity of the case depends largely upon the virulence and intensity of the blood infection. It is essentially, from beginning to end, therefore, an infectious fever, and in order to attack it successfully we must treat this septicemic condition of the blood. Therefore, it seems to me very advisable that these patients should be treated with such antiseptics as can be administered to the individual safely, but which would be destructive to the meningococcus in the blood, and also wherever the blood would carry it into the brain or spinal cord. Such antiseptics for instance, as calomel, sulphur, carbolic acid, creosote, guaiacol, betanaphthol, and certain coal tar derivatives are especially valuable. It seems to me possible that fulminant cases would be favorably influenced by intravenous injections of formalin or Crede's soluble silver, and that their gravity and urgency would warrant giving this method a fair trial.

DR. NORMAN B. GWYN: In 1899 I had the good fortune to witness an epidemic in which we had 12 cases of cerebrospinal fever. I would like to say a few words first as to the transmissibility and contagiousness of the disease. Although we had 11 cases in the hospital under constant observation and seen frequently by doctors, nurses and students, yet there was no development of the infection amongst any of them. On the other hand, one of the patients gave a distinct history of having been 24 hours before in the barracks from which several cases of meningitis had been reported. We saw the development of chronic cases in which a fever, typhoid in type, with the temperature running to 105°–106°, might persist for 5 to 7 weeks. These were cases in which acute symptoms, such as convulsions, would take place, as fluid accumulated and pressure was produced and in each case lumbar puncture was not only of value as a diagnostic measure, but of very material value in relieving the distress of the patients, convulsive seizures being frequently allayed as the fluid was drawn from the subarachnoid space. In some of these cases 3 or 4 ounces of fluid were withdrawn on several occasions, spurting out from the needle to a distance of several inches. We had also a chance to study the cases bacteriologically. The diplococcus intracellularis was obtained without difficulty in every acute case as it came into the hospital, lumbar puncture for diagnosis being performed regularly. As the cases developed into the chronic stage it became more and more difficult to find the organism in the fluid. We also took systematic blood cultures and were able in one case to demonstrate the presence of the meningococcus and in the same case, severe arthritis being present, we are able to find the meningococcus in the joint fluid; reported as the first case of general infection by the diplococcus intracellularis (*Johns Hopkins Bulletin*, 1899). We found in many cases that the severe symptoms of meningeal irritation, such as rigidity, were frequently relieved by immersion in hot water. In one case surgery

was resorted to by Dr. Cushing. This was a case in which the meningeal irritation had developed and the needle brought away thick pus in which the staphylococci were readily demonstrated. The spinal canal and the meninges were opened and freely drained and the patient did remarkably well for some weeks, although he died later from a secondary infection. In one other case reported from Philadelphia before this one by Dr. Musser, although the spinal canal was freely opened, no very favorable results were apparent. The possibility of the disease being a blood infection, requires careful consideration; for, it may be on this account that surgical procedures have failed, and it is more than likely that the failure of medical treatment is due to the same cause. There has been one instance in the Pennsylvania Hospital in which the diplococcus intracellularis was isolated from vegetations on the heart valve, and one further instance of isolation of the organisms from the general circulation. It seems possible, as has been shown with some of our other infectious diseases, such as pneumonia and typhoid fever, that general infection in this condition is much more common than we think and may almost be present from the start. I think Dr. Wilson's cases in which the renal symptoms were so apparent, were probably due to the fact that the primary infection was a general infection and that the kidneys suffered one of the first blows.

DR. W. S. WADSWORTH: The cases that I see would naturally be supposed to be of the most severe type, the reduced condition of the patients, however, in several of the cases undoubtedly had as much to do with the termination as the type and severity of the infection. During the present manifestation of the disease I have cut 6 cases and during the flurry several years ago I cut about the same number. I may mention that the subject is not altogether new to me, for my attention was drawn to the epidemic in Massachusettts while I was a student there 20 years ago and I have always kept an interest in the subject since then. It may be of interest to you to know that some months ago I called the attention of one of the attachees of the office to the account in the papers of the death of a number of horses from the disease and said to him, "Look out for it when the thaw comes." Sure enough, I had a collection of cases following the thaw. This is not scientific proof, but until we know a vast deal more about the diseases we take from horses it is suggestive to those who think. The first case was distinctly unlike the text-book case. This case had a few little spots, marked enteritis and only a light congestion of the brain, with no observable meningitis, so I continued to worry over it in private, and gave a certificate of enteritis. The history was too unreliable to take into account. The next case was also obscure, with a history of recent enteritis, not severe, several physicians in attendance and no diagnosis, few small spots, such as are rarely seen in postmortems on typhoid fever cases. Peyer's patches all recently and markedly involved, mesenteric glands soft and purple and the mark that I have since become familiar with, the small hemorrhages on the intestines, like red ink stains. I did not feel satisfied to call it meningitis without more marked brain lesion, but reported it to the Board of Health as in all probability a type of spotted fever and turned in all the information I had gotten about the

patient's associates. The third case came in as a probable case of poisoning, from a large hospital, and caused me not a little worry and trouble. I found no evidence of any of the poisons that produced convulsions and coma and vomiting; there were those hemorrhages all over the bowels and a marked congestion of the brain. I called in some of my friends who had seen queer cases; the toxicologist disclaimed it and the expert on contagious things shook his head and suggested poison. I wrapped up the brain, notified the Board that it was a case of spotted fever, and went on the search for the history; this I found after considerable search. It was so clear and characteristic that there was no possible doubt left and gave me the assurance that the type was different from any before observed by me. Since then I have seen several cases conforming to the type with such variations as would be natural in the individual affected. The type is clear; the onset is through an enteritis with more or less freely acting bowels, a rather sudden onset of head symptoms and convulsions followed by coma and death in profound depression. The development of spots is apt to mark the infection in the bowel and be independent of the head symptoms, depending on the personal vigor of the intestines and vascular system of the patient. The head symptoms may last a few minutes and if the physician is not very careful in questioning the attendant he may not know there were any; as in one of my cases where the doctor persisted that there were no head symptoms till I took him, after the autopsy, with me and asked the family "when the convulsions had begun." The answer was clear enough, "about ½ hour before she died." The brain may show anything from a slight congestion to compression by pink purulent fluid with secondary deposits of lymph about the base. The vomiting appeared in several cases to be of brain origin. The spots, while appearing to be of vasomotor type, are not so distributed as to indicate a general vasomotor paralysis. The type has become so well marked that it would be well to bear in mind the possibility of a bad enteritis developing these spots and a brain climax. The patient will have a better chance and it won't hurt the doctor's reputation. The type of the disease suggests the use of immersion in hot bath with free use of intestinal antiseptics.

DR. J. P. CROZER GRIFFITH: I wish to speak very briefly of my experience with this disease as seen in the Children's Hospital of this city. Hardly a year goes by in which we do not see cases of cerebrospinal fever. They come in all ways, sometimes several close together, if the disease is prevalent at the time, sometimes 2 or 3 in a family, but usually isolated. We have had practically all the types, from the fulminant form to the mildest kind, very frequently the chronic ones terminating fatally after weeks or months of illness. These are by far the most discouraging. The first cases that I saw in the hospital we put in a separate room, but later we transferred them to the general ward. There was no spread of the infection, and never since has a case been isolated, and there has never been an infection of any other patient in the hospital. I would emphasize the marvelous irregularity in the type. There are few diseases so protean in character as this. In many cases it is impossible to make a diagnosis. In a family group which I saw in consultation practice, one child was an

absolutely typical case, while another had the disease in a mild form, but suffered chiefly from pneumonia. In the third child one would have said there was nothing but pneumonia present, had not the fact of the existence of the other 2 cases directed attention to the existence of a little more rigidity of the neck and a slightly greater abdominal tache than could be called quite normal.

DR. A. E. ROUSSEL: I think it is important to emphasize the fact that even in acute cases the diplococcus intracellularis may not be found on the first examination. I recently read a paper by Lapean, of Bordeaux, in which he details as many as 3 examinations before the organism was isolated. In subacute cases the organism is often not found at all. Last winter I had under observation a case at the Howard Hospital in which lumbar puncture was performed twice and in both instances with negative results. The patient improved, but afterwards passed into a chronic condition. Death occurred outside of the hospital and the postmortem, I am told, was entirely corroborative of the diagnosis. Another point of interest is that in those cases of typhoid fever and influenza which simulate meningitis there is an absence of leukocytosis. Whereas in few of the infectious diseases is there such a high grade of leukocytosis as in the one under consideration. Some years ago, during the prevailing epidemic of influenza, I was enabled to diagnose a case of cerebrospinal meningitis at the Medico-Chirurgical Hospital largely because of the above reasons and verified the same by postmortem. The irregularity of the symptoms and pulse rate is an important point in diagnosis. Dr. Tyson will remember our experience at the Philadelphia Hospital at the time when we had a large number of cases of typhus fever and some of cerebrospinal meningitis, there was comparatively little difficulty in diagnosis because of the marked irregularity of the pulse and temperature in the latter, whereas, in the typhus fever cases the pulse and temperature were much more uniform.

DR. B. FRANKLIN ROYER: Nine cases have been sent to the Municipal Hospital since December; but as I hope to make a full report of them at some future time, I shall now refer to but a few points of interest met with in studying them. In reference to leukocytosis, one case of considerable interest showed 49,000 leukocytes on the fifteenth day of the disease. On admission there was a leukocytosis of 17,600. Eight cases of this series showed a very high count; one was nearly dead on admission and showed a count of but 7,400. In 7 we secured the diplococcus, not only from the spinal fluid but from the nasal mucous membrane. Kernig's sign was present in all. Three gave a positive Widal reaction. In none of these 3 was there any sign of enteric fever. All had retraction of the head and stiffness of the back. Only 2 had opisthotonos. Babinsky's sign was met with frequently. A common symptom first noted by Dr. Holmes, resident bacteriologist, was anesthesia of the conjunctivæ and frequently of the corneæ. This condition is not often noted by American observers, but is refered to by writers abroad. Travers Smith reports it as a common occurrence in the cases in Dublin in 1902. In Dr. Wilson's paper, vomiting has been referred to as a rather common symptom, but in

our 9 cases not one vomited while at the hospital. We had one case of marked keratitis and one of ulcer of the cornea. The latter showed the meningococcus. We have used lumbar puncture for diagnostic purposes and, in several instances in which we felt we had pressure symptoms, for curative purposes, but we did not find any great excess of fluid. I think that was because we were dealing with the fulminant type of the disease. I am not sure that lumbar puncture is curative or greatly palliative except in chronic cases. I remember distinctly a case seen with Dr. Day last summer in Dublin, coming in as an acute case and becoming chronic. It was that of a child in which the anterior fontanelle was not closed, and when there was an excessive accumulation of fluid the anterior fontanelle would bulge and the child would become almost entirely comatose. By doing lumbar puncture the child would become conscious, take nourishment, and even cry for food, to again become comatose at the end of a week or 10 days.

SYMPOSIUM ON X-RAYS IN TUBERCULOSIS.

[April 26.]

Skiagraphic and Therapeutic Factors in Tuberculosis of Bones and Joints.

BY CARL BECK, M. D., of New York.

[By Invitation.]

No medical domain equals in importance that of tuberculosis. If it is realized that still one-seventh of mankind succumbs to some form of tuberculosis, its immense importance needs no further argument. Koch's immortal discovery of the tubercle bacillus as the cause of tuberculosis marks a new era in the knowledge of this scourge of mankind. Knowing the character of the enemy, we are now better prepared for the fight, in which medicine as well as surgery, we are proud to say, has won many triumphs. Surgery especially shows great success in those forms of tuberculosis, which are accessible to early surgical interference. In fact, no domain in the vast field of tuberculosis illustrates the power of surgical means as much as that of the bones and joints.

Surgical procedure, however, is of an indirect nature, since it does not attempt to attack the bacillus itself. It considers especially the tissue-changes brought on by it and contents itself by bringing the tuberculous sphere into conditions that are unfavorable to further

bacterial development. If a fortification cannot be stormed, it may be taken by starving the garrison. The practical application of this principle will be dwelt on below.

The Röntgen rays have become an invaluable ally for studying tuberculous areas and for directing and controlling the influence of our therapeutic means. Especially at an early stage, the diagnosis of osseous or articular tuberculosis could not be made except by the Röntgen method. And after the focus is detected, the skiagraph gives valuable hints for the mode of treatment.

In order to follow these skiagraphic hints, a thorough knowledge of the anatomic changes in the bones and joints is required. First of all, we must bear in mind that tuberculosis of the bone is practically an osteitis or osteomyelitis of a tuberculous origin, whose predilection is for the epiphyses of the long and the diaphyses of the short bones (metacarpus and metatarsus), and the small spongy bones (carpus, tarsus and vertebræ). The flat bones (skull, scapula) are, with the exception of the ribs, but seldom the seat of tuberculous inflammation. An exception to the rule that in the long bones the focus establishes itself in the epiphysis, is furnished by the ulna which, while its upper epiphysis (olecranon) is the seat of predilection, often shows tuberculosis of the whole diaphysis.

The difference of the various anatomic expressions of the tuberculous process depends on its different intensity and extent, as well as on the texture of the various bones. The tubercle bacillus, after having invaded the bone-substance through the circulation as bacterial embolus, so to-day, affects the bloodvessels first. It multiplies more and more, then producing a number of tuberculous nodules which gradually destroy the medullary tissues which are the medium of the nutrition of the bone. Thus osseous trabeculæ are actually absorbed, a granulating focus taking their place, which is largely composed of tubercles. Sometimes a few remnants of osseous trabeculæ are enveloped by them as miniature sequestra. A focus of this kind may be of a circumscribed character and may form in one bone only. It may happen also that several foci form at the same time. Or multiple foci may establish themselves in one and the same bone.

If there be a strong tendency to diffusion and decay, the change shows the cheesy character, the tissues being more and more infiltrated. This infiltrating form of tuberculosis is especially observed at the diaphysis of the short bones, like the metatarsals, the metacarpals and the phalanges. There a circumscribed focus seldom establishes itself,

the whole diaphysis, as a rule, including the epiphyses, becoming a total sequestrum.

A circumscribed focus, confining itself to the center of the bone, may remain there for a long time in temporary innocence, no clinical evidence of it manifesting itself, until some irritation sets up an inflammatory process which is followed by further spreading of the tuberculous process. Then the surface of the bone may be reached and the proliferation of the periosteum there produces new bone, while in the deeper region the old bone is absorbed. This process finds conspicuous expression in the spindle-shaped enlargement of the bone circumference. The homologue of this combination of gradual destruction and construction is the osteomyelitis of the phalanges, ordinarily called "spina ventosa." The same macroscopic impression prevails, however, when the process of destruction confines itself to the cortex while the center of the diaphysis still shows healthy zones. This type of spina ventosa, which is somewhat less frequent, will be dealt with further below.

In speaking of spina ventosa in general the tuberculous type of osteomyelitis is meant. Still it should be remembered that the process may be of a syphilitic or a simple acute infectious nature. As a rule the epiphyses in tuberculous spina ventosa remain normal, but the diaphysis becomes distended and the surrounding tissues swell up so that the finger becomes belly-shaped. The integument may remain intact long before it is affected by the process of granulation and caseation, cortex, periosteum and finally skin being lifted and perforated then.

The long bones react somewhat differently. With the exception of the lower end of the radius their epiphyses show little tendency to periosteal proliferations, as a rule, only small osteophytic areas, resembling stalactites, being there observed. If these changes are well marked, the diagnosis is not difficult. The history, the characteristic appearance of the fistulous tracts discharging cheesy pus, the enlargement of the bone circumference, the oscillating temperature, frequently the simultaneous development of tuberculosis of the lungs or other internal organs, and, last but not least, the microscopic examination of the granulations will remove all doubts. But how about the early stage, when the process is circumscribed and localized, when, in other words, our therapy is so effective, that with few exceptions we shall be able to arrest the process of destruction?

Röntgen's great discovery has fortunately enabled us to fre-

quently recognize a focus at an early stage, thereby enabling us to perform conservative operations which not only save life and limb, but also preserve functional ability. What, now, are the skiagraphic characteristics?

Remembering that in the circumscribed form of tuberculous osteomyelitis, as described above, the trabeculæ are gradually absorbed, granulations taking the place of the oseous tissue, we must naturally expect that under the rays the area thus metamorphosed will appear more translucent. The more extensive the area becomes the greater the absorption of calcareous matter, which also finds its characteristic expression in the greater translucency of the affected sphere. The formation of caseous substance alters this condition but little. The cortex appears more or less distended. If the long bones are concerned there is little periosteal proliferation while skiagraphs of the short bones show it in abundance.

As soon as a circumscribed focus perforates the cortex, the formerly regular shadow of the cortex becomes interrupted and some of the portions appear confluent.

In the infiltrating type of tuberculous osteomyelitis osteoporosis is found. Some of the osseous tissue is absorbed as in the circumscribed type, but most of it becomes necrotic by the inhibition of nutrition. The skiagraphic expression of this process is therefore entirely different from that of the circumscribed foci; the sequestra appear as dark shadows.

Where circumscribed foci only exist, the differentiation from osteomyelitis is sometimes difficult. The anamnesis, however, will often settle the question. In tuberculosis the slow onset and the absence of temperature in a circumscribed (nonperforating) focus and the absence of thickening of the osseous circumference may be regarded more or less pathognomonic in contradistinction to the acute character of the fever and the early thickening and distension of the cortex in simple acute osteomyelitis. In the more advanced stages of acute osteomyelitis the cortex and the periosteum begin to participate in the inflammatory process; the shadow of the sclerotic cortex becomes larger and the ossifying inflammation of the periosteum especially finds its skiagraphic expression in a very light shadow-line running parallel to that dark one of the cortex, while in tuberculous foci sclerosis, or rather eburnation, is extremely rare. The treatment of these two different conditions is the same however, viz., exposure by the chisel. This is done under the mentorship of the

skiagram. The Röntgen method not only localizes the foci, but also outlines their extent so well, that the technical steps of the operation can be definitely traced in advance. The feeling of security the surgeon has while proceeding under the mentorship of the skiagraph gives a satisfaction unknown in former years when often the whole bone had to be exposed in order to ascertain whether but one focus existed or there were others besides. Now, if the Röntgen rays show that only one focus is in question, no other regions of the bone need to be explored. The modus operandi consists, as a rule, in the free exposure of the focus. The iodoform injections, which will be described further below, can be utilized in these cases only when the foci are very near the surface so that an aspiratory needle will pierce the thin bone-shell. Their main habitat in osseous tuberculosis is therefore the short or flat bones.

Foci of this kind, which can be invaded by the injection-needle, are not frequently found, and, as a rule, the scalpel must be used. The large incision should be longitudinal. The periosteum must be carefully preserved by lifting it aside with the periosteal elevator. Then the ceiling of the cavity is chiseled off. Granulations, cheesy masses and other *débris* are removed. The form of the cavity is to be changed now by chiselling off the upper portions of its wall so that a flat groove remains which is partially covered with the well preserved periosteum.

In the infiltrated form, which is especially found in the short bones, the diaphysis may sometimes be preserved. In favorable cases there is but little shortening left. In cases of this kind the margins are partially united, the cavity itself being packed with iodoform gauze (3 per cent.), tightly for the first few days, and loosely later. Immobilization is an important adjuvant. As to further details see below. In more advanced cases, the diaphysis must be removed after the periosteum is carefully lifted from it.

As described above, intraosseous foci in tuberculosis are found at the periphery as well as in the middle. They may be globular or elliptic or tubular. In the latter event the focus may permeate the whole epiphysis and joint-perforation may take place.

On the other hand, if there be a tendency to disturbance of nutritition, as described above, an area of necrosis may form which in most instances assumes the shape of a triangle, the base of which is near the joint surface. This is explained by the arrangement of the nutrient vessels which diverge from the medulla toward the cartilag-

inous surface, so that the area which is supplied by these vessels will become necrotic if the nutrition is inhibited. Thus a cuneiform sequestrum is found. The form may, however, in proportion to the different shape of the various joints be of a more rhomboid shape. The color of the necrotic bone-portion is white at the beginning, as the medulla and Haversian canals are interwoven with pus-cells and cheesy tubercles. In the further course of the exfoliating process a thin tuberculous granulating stratum forms as the only means of coherence between the sequestrum and the healthy tissue.

While in simple acute osteomyelitis the inflammatory process is practically finished as soon as the sequestrum becomes exfoliated, in tuberculous osteomyelitis the infection still progresses further and, if situated near the joint, it invades the cartilage, lifting it from its base or eroding it until there is perforation. Then the liquid contents are discharged into the joint cavity which generally causes violent reaction.

In a case in which the dead fibula was surrounded by an exfoliating cortical zone, in a boy of sixteen years, the symptoms were slight and had begun nine months before the skiagraph was taken. The leg was moderately swollen, an inch and a half above the external malleolus was a fistulous opening discharging seropus. The probe proved the presence of rough bone. Without the information of the rays I would have assumed that there was a small sequestrum, which could be extracted through a short incision. But the skiagraph indicated that the fibula to two-thirds of its extent had become necrotic. I therefore altered my strategy, making an incision over the whole area of necrosis. This enabled me to extract nearly the whole fibula as one sequestrum.

Tuberculosis of the joints is a great deal more frequent than that of the bones proper, and certainly represents the most predominant articular disease. Its diagnosis by another than the Röntgen method at an early stage is impossible, in view of the absence of the clinical symptoms at this period. This is due to the slow development of the process and the absence of pain and functional disturbance then.

At first either the synovial membrane or the osseous epiphysis become involved, the synovial membrane, as a rule, being attacked first. The tuberculous process in the synovial membrane may be circumscribed or diffuse. The circumscribed form is extremely rare and confines itself mostly to the fibrous portions of the synovial membrane, where it forms hard nodules which may vary from the size of a filbert to

that of a walnut. The histologic examination reveals young connective tissue which partially shows signs of fatty degeneration. Decayed tubercles are interspersed. Sometimes there are a few isles of healthy but very vascular tissue left.

In the diffuse type the synovial membrane becomes thickened and reddened. The tuberculous nodules, which form especially at the surface of the synovial sac, can but seldom be recognized with the naked eye, because the very solid membrane is covered with fibrinous exudation. And the nodules themselves show little tendency to caseation. This hyperplastic type often leads to the formation of a serous effusion in the joint (tuberculous hydrops). It may be taken for granted that in all the various types of tuberculosis of the synovial membrane there is a greater or less amount of serum, the fibrin of which deposits itself on the diseased synovial membranes as well as in the various recesses of the joint, where it may become organized. Repeated tuberculous invasion (reinfection) and organization thicken the membrane while at the deeper edges organized fibrin proliferates, covering the cartilage which it finally invades and macerates. Thus the cartilage becomes thinner and appears sieve-like at some portions.

In the further course the destruction may become so extensive, that only small remnants of the cartilage are found at some areas, while the larger portion of the joint surface is occupied by newly formed tissue. The ligaments, as well as the parasynovial tissues, share the same fate. They swell and become softened so that with the surrounding connective tisue they appear like soft jelly. This swelling, which is in strong contrast to atrophy of the noninfected part of the extremity, gives the joint the characteristic spindle-shape, as it is characteristically observed in tuberculosis of the knee joint.

The granulating type prevails among those who have hereditary tendencies, especially among the children of the poorer classes. Sometimes it is observed after an injury, causing effusion, which fails to show any tendency to disappear. After months, articular contraction of the flexors is observed, if the extremities are concerned. The pain may be insignificant during this period of development of the disease. Fever may be absent or very moderate (99.5°) and the general condition but little disturbed. But the patients generally are markedly anemic.

Later the uniform thickening of the joint and the disturbance of function of course leave no diagnostic doubt. It is characteristic

for this more benign form of granulating tuberculous inflammation, that there is no tendency to pus-formation (dry process). It is, therefore, not unnatural, that spontaneous cures often occur. The tuberculous granulating inflammation proper, with its tendency to more rapid destruction, shows marked clinical symptoms. Swelling and muscular contraction develop within a few months and the patient becomes emaciated. The rapid caseation of the granulations and the perforation into the paraarticular tissues finds its expression in the regular evening temperatures. Some areas of the tumefaction become softened and give the feeling of fluctuation. If there is no surgical interference, perforation may take place and fistulous tracts will form from which cheesy pus is discharged.

The Röntgen rays often enable us to recognize these changes before the clinical signs described are present.

In the first place it will be possible to determine by skiagraphy, whether the primary seat is in the joint or in the bone itself? This question is, as a rule, of great importance in the treatment, since in case of oessous origin, as described above, exposure or evidement would, with few exceptions, be indicated. In case of primary affection of the synovial membrane, naturally no focus could be detected. But the irregular thickening of the synovial membrane finds its skiagraphic expression in the irregular outlines of the joint line, which at the same time appears diffused, cloudy and often shaggy.

In the fibrous form the shadows naturally are darkened. If the process of destruction reaches the cartilage its erosion is indicated by its saw-like appearance. If the cortex is reached, the impression is left as if a piece had been bitten out. The invasion of the paraarticular tissue find its skiagraphic expression in the irregular dark shadows, which prevail in contrast to the light shadows, which latter point to the absorption of calcareous matter as a consequence of the inflammatory reaction. This phenomenon is found to a greater or less extent in all cases of bone or joint tuberculosis, some areas showing it more marked than others, according to the greater or less intensity of the process at the various affected zones. The cuneiform or triangular necrosis in the immediate vicinity of the joint, as described above, shows the exfoliating sequestrum as a darker shadow, in which the osseous texture has become lost. If there is tuberculous hydrops, the joint gap becomes enlarged in proportion to the amount of distension of the joint. One condyle, sometimes both, become hypertrophied. Later, when there is no interference, indentation of the joint-line, as alluded to above, supervenes.

These diagnostic points apply to all joints more or less. Still it should not be lost sight of that the skiagraphic features of some joints are influenced by their special anatomic peculiarities.

In the hipjoint, for instance, a regular semicircular light area is constantly found between the femoral head and the acetabulum (healthy cartilage) under normal circumstances, while in tuberculosis the regular articular outlines first become slightly irregular and diffuse. Later, stalactite-shaped projections are often found as the expression of fungous destructions around the ruins of bone. Of course when the destruction has advanced so far that the head becomes severed, the remnant of the femoral neck becoming displaced upwards, the diagnosis can be made without the Röntgen method. But nowadays it should not go so far.

As described above, thorough information is of great importance in regard to the proper selection of the therapeutic means. While in the osseus forms exposure and evidement is the main treatment, synovial tuberculosis should be treated in a much more conservative manner. The treatment *par excellence* for these cases is the intra-articular injection of iodoform-glycerin. Since von Mikulicz tried this drug at the clinic of Billroth, nearly twenty-five years ago, shortly after von Mosetig-Moorhof had demonstrated the great value of iodoform as an antiseptic, this treatment has been successful in the hands of Fränkel, Andrassy, von Bruns, Senn and other surgeons besides myself. It is a surprising fact that in spite of the miraculous results reported by trustworthy men, this method has not become popular. In many instances in which I learned through some of my colleagues that they were unsuccessful in this respect, I have found that their failure was mainly due to its injudicious use and especially to its application in cases which were advanced too far. When there is extensive necrosis, when fistulæ have formed, when there is paraarticular destruction, the proper remedy consists in the wide opening of the affected area and thorough extirpation of diseased synovialis and caseous and necrotic bone foci. During twenty-three years observation, I remember very few cases of localized cases of tuberculous synovitis, which did not get well under this treatment, provided they were treated at an early stage. The only joint I except is the hip. This does not prove anything against the method however as such, as there are some technical difficulties due to the peculiar anatomic relations of this joint.

The X-Rays in the Diagnosis of Pulmonary Tuberculosis.

BY G. E. PFAHLER, M. D.

It is generally conceded that if pulmonary tuberculosis can be diagnosed early it can be cured, and the earlier it is diagnosed the more readily is it cured. It is desirable that the diagnosis should be made before the bacilli can be detected in the sputum, and at times it should be made before a cough manifests itself. I believe that this can be done more accurately with the X-rays than by any other means at our command. The information obtained through the X-rays should not be used as the only evidence, but as additional or confirmatory evidence.

The X-rays have been used for a number of years in the study of tuberculosis of the lungs. One of the early workers in this field was Williams, of Boston. He as well as the rest of us, however, depended upon the fluoroscope, because the moving shadows could not be well recorded upon the plate. Kassabian tried to overcome the effect of movement by making the exposures upon the installment plan, and presented in 1902 a skiagraph made by this method in thirty seconds. Hulst the same year showed skiagraphs of the chest made in one and one-half seconds.

Negatives made on the installment plan are unsatisfactory because it is almost impossible to get a patient to stop breathing with the lungs and diaphragm in the same position twice. On the other hand, when the exposures are reduced to a second, the plate is much underexposed and requires very strong developer, which gives a hard negative with much of the detail lost.

Even a second is too long an exposure to study the movements of the heart. For all practical purposes, an exposure made during the time in which the patient holds his breath is instantaneous—that is, the parts are quiet and can be photographed in position. This will require that the exposure be made in from five to twenty seconds. There are few patients requiring an X-ray examination who cannot hold their breath five seconds and few who can hold it more than twenty seconds.

In order to accomplish good results in this short time, the tube must be in condition to receive a maximum amount of current at once. It is, therefore, well to test the tube always before the exposure is made. The patient must be under the operator's control, which is accomplished by having the patient hold the breath several times as

a test. This will also give the operator a chance to estimate the time during which the exposure must be made.

The clearness of the shadows on the negative will be considerably influenced by the thickness of the chest wall. Fat and muscle cast a very decided but general shadow, and will obscure the lung shadows to a considerable extent.

As a rule, I place the patient in the supine position, but when a pleural effusion is present or a pneumothorax is suspected, I place the patient in the sitting posture. The tube is placed at a distance of eighteen to twenty inches from the plate, in the median line, on a level with the third interspace. If the condition of the pleura is to be studied anteriorly the patient must be placed in the prone position.

Under these conditions deposits one-quarter of an inch in diameter can be detected, and an experienced eye can separate the old fibrous tissue or scar and calcareous deposits from the new lesions. Cavities, consolidations, abscesses, displacements of the heart or enlargement of the mediastinal glands can be detected.

In days gone by, the fluoroscope seemed to offer distinct advantage over the photograph, but the plate is distinctly more sensitive than the fluoroscope and the eye, and since the lung can be photographed in the resting position, the latter has little use. If we can see the actual shadows of each tuberculous deposit, we do not need to guess about it by estimating the relative movement of the diaphragm on each side. Since we can obtain an accurate record of each deposit we do not have to estimate the comparative density of shadow on each side. Therefore, since fluoroscopy adds nothing, but exposes the operator to a dangerous amount of rays, I have discontinued its use in the study of the lungs.

By the X-rays we not only recognize the active lesions, but the small calcified tubercles which must of necessity escape our ordinary methods of physical diagnosis.

The X-ray examination is also important as an accurate and permanent record of the case. By this means we can compare and estimate the progress in each particular lesion by comparision of the shadows.

Interpretation.—Tuberculous deposits cast definite shadows corresponding to their size, location and consistency. Recent lesions of the same size are less dense than old lesions in which calcareous deposits or cicatricial tissue has developed.

Cavities are indicated by a well marked area of transparency sur-

rounded by a more dense wall, which corresponds to the surrounding area of consolidation.

Pleural thickening is shown by a rather diffuse, uniform shadow, which lacks the usual mottled appearance seen in infiltration of the lungs.

Pleural effusion is recognized by a general uniform shadow occupying the lower part of one or both sides of the chest and having a definite upper border.

Pneumothorax is recognized by a very large transparent area occupying one side of the chest, extending in a vertical direction and usually having at its lower portion the shadow of fluid. If examined with the fluoroscope, the upper border of the fluid can be seen to move with each movement of the patient or diaphragm, and if the patient is shaken it can be seen to splash.

A consolidation can be seen through the fluid of pleural effusion. This was seen in one of the skiagraphs demonstrated. An interesting feature in this case was the presence of tubular breathing over the entire area of effusion. The presence of this consolidation could not be clearly demonstrated by physical examination. It is possible that this peculiar physical sign may be explained at times by the presence of a consolidation which transmits the vibrations of the voice and breath from the bronchi to the fluid and thence through the chest wall to the ear.

We must, of course, suspect tuberculosis before an X-ray examination will be undertaken. It should not be our aim to replace ordinary physical examination, but should add the results of the X-ray examination as so much additional evidence.

I believe, therefore, that the X-rays are of distinct value in making a diagnosis; that lesions can be detected more accurately than by any other method; and finally, that it is the most accurate method of recording these lesions.

The X-Rays in Superficial Tuberculosis.

BY WILLIAM S. NEWCOMET, M.D.

The Röntgen ray as a remedial agent in certain cases of superficial tuberculosis may now almost be regarded as a specific, yet if one follows the journals closely, it will be found that many in our profession fail to accept this view and still recommend other forms of treat-

ment, which they deem more practical, if not better. For instance an Italian authority only lately in an article, dwells upon the fact, that thorough cauterization and curretting is the best mode of treatment in cases of lupus. Another rather interesting and very novel method has been recommended by Bouveyron, of Lyons, who in a very rebellious case of lupus, obtained a most gratifying result, from a dressing containing five grains of uranium nitrate. The benefit in this instance, he believes, is due to the fact that uranium gives off rays like radium, being, however, 20,000 less powerful. If this dressing has proved so efficient, it might be suggested that the radioactive portion of the uranium nitrate be separated and that alone used; thereby increasing the radioactivity. This peculiar property that might be styled a concentration of the radioactive portion of the salt is not alone peculiar to the one just considered, but is also true of thorium, which is very rare and consequently very expensive. Uranium, on the other hand, is usually easy to procure and if it proves useful will be most valuable where X-ray apparatus cannot be procured. In fact there is still considerable discussion as to just the ray which is most useful in the treatment of these more superficial cases, and at this time it cannot be definitely decided, as the opinions upon this subject still remain in many instances quite contradictory. The only fact upon which most authorities agree is, that where penetration is needed, the X-rays should be employed.

The use of the Röntgen rays in many instances is often set aside on account of its expense and the length of time required to treat the individual case; this objection is greatly obviated by the use of a cabinet in which four cases are treated at one sitting, by the same tube. The only adjustment needed is the distance to the individual case, and all four cases must require the same amount of penetration. It can be easily seen how this will save the wear and tear of the apparatus. The question is frequently asked, are the results from the treatments given with this cabinet as good as when each case is treated alone, and it might be stated that it has now been in use for over two years and clinically no difference can be seen. This question is due to the fact that many persons believe that the X-rays from an X-ray focus tube are stronger in certain parts, an idea which has gone broadcast, due to an erroneous statement made in several books. It is most unfortunate that we cannot concentrate the energy upon a certain spot or spots. The saving of energy would be enormous, under these circumstances, and the danger of burns would also be materially lessened.

However, the results obtained by the employment of the X-rays in the various forms of tuberculous ulceration certainly justifies our position in trying to bring it more to the notice of the general profession. This fact is well illustrated by the collection of a large number of cases and their careful tabulation by Bullitt, of Louisville. The largest number was of lupus, a total of 616 cases. Of these, 420 or 68 per cent. were cured; 148 or 24 per cent. improved, and forty-eight or 8 per cent. failed. Another author, Kassabian, states that 95 per cent. of all lupus cases yield to the treatment, although the results are very good, it matters not whether we take the former's percentages of 68 per cent. cured and 24 per cent. improved, or the latter's 95 per cent. cured, the discrepancy must be accounted for either from the difference between the individual operator, his method and technique or mistakes in diagnosis. True lupus is, as you all know, a comparatively rare disease in this country, that is when we compare the number of cases in the United States with England and the Continent, and while speaking some time ago about this point to one of our well-known dermatologists, who had just returned from a visit to Germany; he stated that a celebrated German said he did not believe that lupus was so rare, that the difference was only fewer cases were recognized. It is certainly strange how different the same point will appear when observed by different individuals.

The next group collected by Bullitt in regard to size, is tuberculous adenitis. The results here do not appear to be quite as good, but when we consider the disease, and its frightful tendency to recur, they are most promising. In a total of 226 cases seventy-nine or 35 per cent. were cured; ninety-two or 40 per cent. improved, and fifty-five or 25 per cent. failed. It must be remembered that quite a number of these cases occur in children, and they are always difficult to treat, being wearied by the length of time they must sit still, and as often the parents are themselves indifferent. Personally, it has been my fortune to have had very few failures and the most of them can be attributed to the cause just given.

This brings us to the consideration of the treatment of tuberculous glands that have not broken down, and several points arise for adverse criticism. It cannot be denied that these cases do not do well, the gland or glands will often entirely disappear, generally, however, they shrink, leaving a small mass about the size of a cherry stone, but how is the condition eliminated from the system. The X-rays will certainly disseminate the mass, and does it without scarring,

literally without the loss of any tissue, which, considering that these cases usually occur in the neck, and often in women, is a fact that makes operation most objectionable and repulsive. Then the only question that remains to be solved is: does it also eliminate the disease? This must be closely studied, and the only answer can be in clinical observation; however, if cases of pulmonary tuberculosis can be cured by proper treatment, diet and hygiene, why is it not possible to do the same in these cases?

No doubt many cases of all forms of tuberculosis fail to respond to the use of the Röntgen rays for the simple reason that their general health is not properly regarded, tonics, outdoor exercise and proper hygiene in general is as necessary when your patient is under the X-ray treatment, as it is when you are carrying out any line of treatment. The Röntgen rays seem to have some remarkable power to correct and regenerate faulty metabolic processes, but like all other remedial agents it has its limits, and certainly, all things being equal, the results will be better in those cases in which they are consistently assisted by other methods, than in those in which they are simply depending upon one line of treatment. Therefore, when treating tuberculous diseases by the Röntgen rays, always remember that the general system is as much to be treated as the local manifestation.

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The X-Rays in the Treatment of Deep-Seated Tuberculosis.

BY HENRY K. PANCOAST, M. D.

The object of this paper is to present the results obtained in the treatment of all the cases that have come under our care in the X-ray laboratory of the University Hospital. The areas including the deep-seated lesions are the larynx, lungs, peritoneum, joints and spine. The lymphatic glands are considered by Dr. Newcomet among the superficial lesions. A general report of the treatment of the deep manifestations of tuberculosis must, at this present date, contain more failures than positive results. But an occasional cure in treating conditions for which successful therapeutic agents are still undiscovered, for the most part, should give to the X-ray specialist the stimulus

to put forth his best efforts in a field open for so much research. Our failures to combat the deep-seated lesions with the ease and success obtained in overcoming the superficial processes must be due to one of two causes, mainly. Either we are employing an agent of little therapeutic value, or our technique is far from being perfect. It would seem worth our while to assume that the latter reason is at least partly correct.

The first of the deeper lesions to be considered is *tuberculous laryngitis,* and secondarily, the pulmonary manifestation, which is practically always found in conjunction with it.

CASE I.—J. K., white, male, aged 37 years, nativity and residence Philadelphia, occupation, driver and motorman. Referred by Dr. W. G. B. Harland. Diagnosis, tuberculous laryngitis and consolidation of right apex with softening. No tuberculous family history except possibly in father. The patient had an attack of pleurisy in 1895, but fully recovered. Otherwise the personal history was negative until March, 1903, he began to lose weight, from 138 to 121 pounds. The following month the diagnosis of phthisis was made, and at that time the throat began to be sore and at times he lost control of his voice. In June, 1903, Dr. Harland reported the following: Weight, 122 pounds, cough, tubercle bacilli in the sputum, hoarseness, dryness of the throat, occasional aphonia, flushing, night sweats, and a consolidation with softening at the right apex. Laryngoscopic examination revealed an ulcer on the left side of the epiglottis and a slight hyperemia of the cords. Local and general treatment was given. In September the general and local conditions were much improved, as evidenced by the disappearance of cough and night sweats, and a gain of 10 pounds in weight. In October he contracted a severe cold, and became worse. The laryngoscope showed a perichondritis of the upper left part of the epiglottis and some swelling of the commissure. For a period of 4 weeks, during November, at the time of the beginning of the "radium craze," exposures were made by a specimen of radium bromid of 18,000 activity.

There were twelve applications varying from ten to forty-five minutes each, without result. (I may add here that I have very little confidence in the value of radium as a therapeutic agent. Admitting that its wide spread use has yielded some brilliant results and that some small credit must be given to it, it does not seem proven that it will accomplish anything that the X-rays will *not* do, and it certainly falls far short of doing what the X-rays *will* do.)

Dr. Harland referred the patient for X-ray treatment February 8, 1904. His examination then showed ulceration of the epiglottis and a tuberculoma of the commissure. Five minute applications were made to each side of the neck alternately, and the apices were exposed each time. After 8 weeks' treatment the inflamed area of the epiglottis had lessened, but the tuber-

culoma was larger, and the throat felt worse. An interval of one week of rest was given and then after 8 weeks more of X-ray treatment Dr. Harland reported that the ulceration had almost healed, the tuberculoma was pale and shrunken, and all signs of inflammation had disappeared. The lung condition was then about the same and the weight varied from 126 to 132 pounds. Exposures were continued until September, 1904, 69 being given over a period of 32½ weeks, and the average length of the applications was 5 to 8 minutes. A medium tube was used, having a resistance of about 8 inches of spark gap, and the anode was placed 12 inches from the patient. There was always a decided skin reaction present.

Dr. Stanton examined the patient January, 1905, and reported that the old lesion in the apex could scarcely be located. Dr. Harland reports the larynx cured, and that the patient works regularly and seems to be in perfect health, and weighs 135 pounds, a gain of 13 pounds.

CASE 2.—W. D. A., white, male, aged 36 years; nativity, Washington, D. C.; residence, Philadelphia; single; occupation, broker. Referred by Dr. Alburger for X-ray or Finsen light treatment of an advanced tuberculous laryngitis complicating a pulmonary lesion of each apex, with a small cavity in the right apex. No tuberculous family history. He had been receiving "open air" treatment in a sanatorium, and was living in a tent night and day during zero weather. The condition of his larynx was such that every effort at swallowing was agonizing, and it was desired that this dysphagia be relieved or the patient's life would soon end from lack of nourishment at least. In January, 1905, Dr. Fetterolf reports: "Both artenoids were badly infiltrated and swollen and the left cord was more or less fixed in a position of semiabduction." X-ray and Finsen light exposures were begun February 19, 1905, at which time his weight was 101 pounds. After one week of daily exposures of both kinds, he had gained 4 pounds, felt better and stronger, the throat was not so sore and swallowing was much easier, and he was able to sleep all night. After 10 days the throat became worse, and X-ray applications were discontinued for a short time, but soon resumed on alternate days, and of 5 minutes duration instead of 10. Daily Finsen exposures were continued throughout the treatment. At the end of 2 weeks, examination showed 2 tuberculomata on the right cord, nearly ready to ulcerate. Dysphagia was intense. After a few days more he felt greatly relieved and continued to swallow with reasonable comfort until he left the hospital a week ago. The tuberculomata had then disappeared, the right cord was not so swollen, and the left was also less swollen and more movable. His lung condition had certainly not grown worse, his cough was better, and the only unfavorable sign was a continued loss of weight after the first gain.

CASE 3.—E. N., white, female, aged 34 years, married. Referred by Dr. Stout, assistant in our X-ray laboratory. Diagnosis, tuberculous laryngitis complicating a pulmonary lesion of the right apex. The latter condition is of 4 years' duration and the former 3 months. X-ray treatment was begun February 13, 1905, by Dr. Stout and myself. She had lost 15 pounds in 3 months, could swallow liquids only, and spoke in almost a whisper. Examination of the larynx showed swelling and redness of

both cords. Up to the present time 30 applications have been made, during a period of 10 weeks. Each side of the neck has been exposed alternately for 10 minutes, and the upper thorax every time, through the clothing. A hard tube with a resistance equal to 3 to 4 inches of spark gap has been used, with a current of 2 to 3 milliamperes in the secondary. After the fifth treatment, swallowing was easier, after the fourteenth, decidedly improved, but worse after the fifteenth. A reduction in dosage was followed by improvement. A second relapse required a second reduction later. At the present time her throat hurts but seldom, she can swallow anything without discomfort, has gained 8 pounds, coughs less, looks and feels better and is stronger.

CASE 4.—A. G., white, female, aged 22 years, single, dressmaker. Referred by nose and throat dispensary. Diagnosis, tuberculous laryngitis complicating a pulmonary lesion of the left side. One brother died of marasmus and one has tuberculous adenitis. Dr. Singer reported a tuberculoma of the interarytenoid space. She has had 10 applications in 3 weeks, and her throat feels better. The usual improvement noted after the first few treatments was followed by a period of reaction requiring a decrease in dosage, and subsequently the progress was favorable.

From these cases the following conclusions are to be drawn:

(1) Tuberculous laryngitis may be aided and even cured by X-ray treatment, provided there can be brought about an improvement in the primary pulmonary condition, however that may be induced.

(2) Too vigorous treatment will cause a reaction, which may be carried to an unfavorable degree; therefore, great care is necessary in determining the proper dosage in each case.

(3) The pulmonary lesions may be benefited, probably, in selected cases, but even greater precautions should be observed.

(4) Finsen light applications may be, but are probably not of any value in treating the laryngeal lesions. Only the most powerful lamps need be tried. Such exposures are of value in lessening or retarding a skin reaction from the X-rays.

Tuberculous Peritonitis.—During the summer of 1904, Dr. Shober referred to me for treatment during his absence a patient upon whom he had been using X-ray applications for tuberculous peritonitis. During eleven weeks under my care she received thirteen exposures, and was then sent back to Dr. Shober. Her cure was a complete one, and she was practically well when she came to me. I have asked Dr. Shober in the discussion to report this case.

We are at present treating a second case of this kind. Applications were begun as soon as the laparotomy wound was healed, and

since the first of this month, fourteen exposures have been made. Improvement is to be noted, but it is too early to make any definite report. In all such patients receiving X-ray treatment following an exploratory laparotomy, it would be difficult to determine how much benefit results from the X-ray therapy and how much from the operation, as we all know the frequency of cures which are in some manner brought about by opening the peritoneal cavity.

Joints.—We are now giving X-ray therapy a trial in the treatment of joint lesions, but so far the results have not been noteworthy. Such applications can be of value only when the usual surgical methods are rigorously carried out. The same remarks are applicable in connection with our experiments with tuberculous caries of the spine.

DISCUSSION.

Before the reading of the formal papers, Dr. W. S. Newcomet exhibited (1) a case of tuberculous ulceration (lupus) in which there was great difficulty in getting the exact amount of X-rays to produce the desired result; (2) a case of tuberculous glands under both angles of the jaw, which was under treatment for 4 months. (3) A case of tuberculous sinus under angle of jaw, following operation upon glands. (4) A case of tuberculous sinus with enlarged gland, and keloid following operation, in which the patient has been under treatment for 3 or 4 months, and which illustrates one of the failures. It first looked as if the efforts would prove successful, the sinus healed, the keloid became much smaller, but as soon as X-ray treatment was stopped the sinus again opened. The keloid has not enlarged, however.

DR. WILLIAM L. RODMAN: I agree with Dr. Beck in the high value he places upon the value of the X-rays as a diagnostic means in tuberculosis of the bone and in all lesions about the bone. It is perhaps the best way to make an early diagnosis of periosteal or endosteal sinuses. I also agree with him that an early diagnosis of tuberculous affections in a bone makes possible early and successful surgery. I fully agree with the position just stated that as yet we cannot expect much from the treatment of obscure lesions of the joints by the X-rays, but that it should be used as supplementary to surgery. I agree with Dr. Newcomet regarding the value of the X-rays in superficial ulcers, particularly those of the skin, and yet I am not quite so optimistic as he, for according to his own statistics at least 32% are not cured by the X-rays. Where you have practically $^1/_3$ of the cases uncured it will hardly do to say that such a treatment is a specific. Yet it cures a majority and should have the preference because it leaves less scarring than excision, caustics or almost any other form of treatment. I further agree with Dr. Newcomet that all such patients should have the benefit of general treatment. Such patients cannot have too much good food, sunshine and fresh air at all times during the 24 hours. I also believe that the X-rays do good in enlarged glands, and

yet I believe that they should be used only as supplementary to surgery. Operations for enlarged glands, it is true, are not always successful, but this is usually due to incomplete operations. If one does not make a free incision and expose glands which are *apt* to be coincidentally enlarged, recurrence will be frequent. I take it that all small glands overlooked in the operation may be attended to by the X-rays. My custom is to send such patients to Dr. Pfahler and have them undergo a course of X-ray treatment. This course will give better results than if either treatment is used alone. Another field for the X-rays is in the dissipation of the thickening about the gland in the cellular tissue and muscles that so frequently occurs after these rather extensive operations upon the neck. I think we cannot expect much from the X-ray treatment of joints, tuberculous peritonitis and all of the different forms of internal tuberculosis. It seems to me that here surgery is reasonably satisfactory, and in an incipient case I would certainly prefer iodoform injections with which I have had excellent results, particularly about the wrist joint, where surgical procedures do not seem to be followed by the very best results. I think Senn has done much to popularize this treatment. In the next class of cases I think open arthrotomy with drainage would be the best thing. In more advanced cases, erasion or complete resection leads to improvement in the usefulness of the limb. I should limit the use of the X-ray treatment to those cases that have been operated on and given the benefit of surgical procedures which have been pretty well tried and are in established use.

DR. S. S. COHEN: The skiagrams exhibited by Dr. Pfahler leave no question that pictures of this kind will locate more accurately and circumscribe more definitely the lesions present than most of us can do by the ordinary means of physical diagnosis. Their great value not only diagnostically but as records of progress, favorable or unfavorable, is self-evident. On the other hand, I believe that physical diagnosis is competent, in expert hands, to demonstrate the existence of tuberculous infiltration of the lungs as early as the X-rays. I remember a patient whom I had seen in consultation, and who went, unnecessarily in my opinion, to a certain health resort. The well-known physician under whose care he there came was surprised at the diagnosis of tuberculosis, bacilli being absent from the sputum and the signs in the lungs to his ear not being sufficient. A skiagram failed to show anything. He thought it necessary to inject tuberculin, to which there was prompt reaction. Admit that this was an early and difficult case, and that the question of skill is concerned, it is still evident that mistake in interpretation of X-ray results is as easy as mistake in physical diagnosis. I am not deprecating the skiagraphic method; on the contrary I highly appreciate it and think its use should become larger and larger, but I do not wish the acoustic methods to be neglected. By such methods in every instance the expert ought to be able to recognize early tuberculous disease in good time with proper care. I should like very much to see the application of the stereoscopic method to skiagraphy of the chest. Perhaps Dr. Kassabian can enlighten us as to its possibility. Such pictures would be invaluable for demonstration and would greatly assist our comprehension of the extent and distribution of the

morbid changes. The very conservative reports we have heard leave no doubt in regard to the therapeutic value of the X-rays in some cases of laryngeal tuberculosis, and its use should be encouraged. While there are other methods which sometimes accomplish equally good results, these are restricted to hands thoroughly expert in intralaryngeal manipulations; nor is there any greater certainty of their success. Many failures are to be expected in all methods. The principle here applicable is destruction of morbid tissue to permit regeneration of healthy tissue or of durable cicatrices; and irradation is to be expected to be serviceable in just such cases. As to treatment of tuberculous glands by Röntgenism I have seen cases benefitted by the treatment, and I have seen cases in which no improvement was manifest. I have seen a larger number of cases in which after thorough surgery the application of X-rays seemed to help in preventing recurrence. I take my stand alongside of Dr. Rodman; that, for the present, in all operable cases operation should first be done and then the X-rays used. It thus becomes our most valuable supplementary measure. As in diagnosis, so in therapeutics, we are not tied to any exclusive method, and we should be foolish to limit ourselves to the use of any one method or agent in any case in which the combination of a number of methods or agents is more effective. I should like to ask the surgeons present whether in the use of iodoform injections in tuberculous joints they have ever combined the use of the X-rays with iodoform injections, and what the effect might be or has been under such circumstances?

DR. JUDSON DALAND: I desire to confine my remarks to the subject of diagnosis from the X-ray standpoint. I think but few realize the extraordinary advance that has been made in technique. The statement of Dr. Pfahler that in from 3 to 20 seconds a satisfactory negative of the thorax may be produced under conditions that may be accurately duplicated, is of great importance primarily for diagnosis and secondarily for noting the progress of any lesion which may be under observation. One of the most important and beautiful points in this new work is the extraordinary accuracy with which the topography of the thoracic cavity is represented. The interesting point is that we are shown the exact location and extent of the lesions by the curves or shadows which differentiate pathologic conditions. The exactitude of this study morphologically makes this study comparable to an antemortem postmortem. A study of the outline of the area of consolidation is most important diagnostically. Ordinarily percussion is not as exact, and we have in the X-rays a diagnostic aid which is already of extraordinary value. We must recollect furthermore that in the examination of evidence thus produced no one is so able to interpret these plates as the one who made them. The X-ray negatives as we have seen them this evening represent a most extraordinary advance in the accuracy of diagnosis. The case referred to, in which the changes in pulmonary tuberculosis were observed at intervals of 3 months, was one in which the X-rays demonstrated far more tuberculous infiltration than was revealed by the physical examination. The pulmonary symptoms were not well-marked and could have been easily overlooked, but when the results of physical examination were placed beside those obtained

by the X-rays I was much impressed by the additional information yielded by this method of diagnosis. Another point is that the tuberculous area as demonstrated by the ordinary methods is almost always smaller than the lesion revealed at autopsy or by the negative. As a negative can now be taken between breaths and be exactly duplicated at any time subsequently, the X-ray method is far more valuable now than at any time in the past. There is no antagonism between this method of diagnosis and any other; it is simply an additional method of investigation and represents one of the most important advances in demonstrating conditions within the thorax, many of which are most obscure. I believe this particular method of diagnosis has reached a point at which every important intrathoracic case necessitates a thorough and careful X-ray examination.

DR. JOHN B. SHOBER described a case of advanced tuberculous peritonitis in which, owing to the dense adhesions and large masses of thickened omentum, mesentery and large, caseating retroperitoneal glands and the general pelvic adhesions, it was found at operation impossible to remove the tubes and ovaries, which were evidently the seat of the primary focus of the disease. The abdomen was flushed with normal salt solution and closed without drainage. There was a temporary marked improvement with gain in weight, but 5 months later after a slight reappearance of the menses, which had been absent for more than a year, a recurrence of all symptoms at once took place. The patient refusing a second operation, treatment by X-rays was begun and resulted in a prompt relief of all symptoms. Palpable masses in the abdomen seemed to melt away and pain was promptly relieved. After a period of 8 weeks the patient described herself as feeling as well as ever in her life. She discontinued treatment, but returned after 2 months with renewed symptoms. Treatments were begun again 2 or 3 times weekly, and continued for 14 weeks, the patient at the same time being kept in a state of artificial fluorescence by taking fluorescin, quinin bisulphate and radioactive water after the method of Dr. William J. Morton, of New York. She had 27 treatments in all, each 7 to 10 minutes, from a Queen's self-regulating tube at 10 inches distance from surface to anode, directed anteriorly, posteriorly and to each side in turn, no shielding. A Leeds' 7-inch coil run from 15 volts in storage battery with mechanical interrupter was used. There was always 3½ to 4 amperes in the primary and the tube backed up 4 inches spark gap on coil. At the end of the second course of treatments there were no subjective or objective symptoms of peritonitis, and upon examination she was found to be pregnant. She miscarried in the third month, and a slight recurrence of symptoms took place. At this time she was referred to Dr. Pancoast for a course of X-ray treatment, to which she promptly responded as before. There has been no return of symptoms since. This case seems to indicate that the X-rays exert a decidedly beneficial influence on tuberculous peritonitis.

DR. KASSABIAN: Tuberculosis of bone is often differentiated with difficulty from syphilis, owing to the marked resemblance of the shadows on the negative. The early stages of a tuberculous arthritis closely simulate a simple synovitis and arthritis, but when the typical skiagraphic appearance is produced diagnosis becomes easy.

Pulmonary Tuberculosis.—The X-ray method of examining the thorax, especially in tuberculous conditions, is an invaluable aid in diagnosis. It reveals the presence of an incipient tuberculosis before the physical signs are reliable and likewise when the bacilli are not found in the sputum. I made some negatives in 1899 in the service of Dr. James M. Anders at the Medico-Chirurgical Hospital. Dr. Anders reported the cases in a paper entitled "The Pre-Bacillary Stages of Tuberculosis" in the *Journal of the American Medical Association*, January 12, 1901, and I also reported these cases before the American Congress of Tuberculosis in New York in 1902. One month after an X-ray diagnosis was made, corroboration was found in the physical signs; and at this time tubercle bacilli were demonstrated in the sputum. Therefore, one month prior to the clinical interpretation of the disease the X-rays disclosed the true nature of the malady. In reply to Dr. Cohen's query, I would say that I have been making a number of skiagrams of tuberculous conditions, including cavity formations and areas of consolidation, and hope to perfect their exposition by the process of stereoscopy. Satisfactory results from X-rays have been numerous in superficial tuberculous conditions, as well as in the deeper structures, in patients that I have treated at the Philadelphia General Hospital. May we hope that as technique improves and our knowledge grows broader the deep-seated affections of the pulmonary structure may yield the same splendid and encouraging results that to-day crown our efforts in the therapy of the superficial parts.

DR. MASON MCCOLLIN: I can endorse almost everything that has been said. In some of these cases of tuberculous adenitis there is a fibroid change taking place, which I have also observed in the mammary glands.

DR. H. E. WETHERILL: I would like to call attention to an instrument of mine for measuring the area of dulness as in different X-ray pictures and by which it is possible to get the volume of the whole affected area. It is also possible by it to measure the exact length of any curved projection.

DR. NEWCOMET: I was glad to hear Dr. Daland's remarks, for a year ago, in a paper published in the *Therapeutic Gazette*, attention was drawn to the use of the X-days in this field. A month or two afterwards a letter was published from a practitioner living somewhere in the Middle West challenging nearly everything I had stated.

Gastrojejunostomy for Benign Stenosis of the Pylorus.

BY WILLIAM H. MORRISON, M. D.

[Read April 12.]

The treatment of diseases of the stomach by surgical methods has, in the past five years, been the subject of wide-spread study and investigation. Not only has operation been resorted to in gastric affections long recognized as surgical, such as carcinomatous and other

tumors of the stomach and mechanical obstruction at the cardiac and pyloric orifices, but more recently, operation has also been employed in those affections which have been regarded as strictly medical, such as simple gastric ulcer and gastric hemorrhage. In fact in a number of instances, operation has been successfully resorted to for the relief of the symptom hemorrhage, no attempt being made to directly reach the cause of the bleeding. The object of the present communication, however, is not to review this interesting and instructive subject, but simply to add to those cases already reported, another illustration of the beneficial results of surgery in certain gastric diseases.

The history of the case is as follows:

J. A., male, aged 44 years, steam engineer by occupation. Both father and mother died at an advanced age. Family and personal history negative. In the fall of 1900, while engineer of a steam shovel, he received a severe blow in the epigastrium from a long lever connected with the machinery. The blow was sufficiently strong to knock him down, but was followed by no apparent bad results. In May, 1901, while at work he had a sudden attack of weakness and was compelled to lie down for 3 or 4 hours. When he raised up he was seized with vertigo and nausea, vomiting a large quantity of clotted blood and also bright blood. There was only the one hemorrhage and at the end of 2 weeks he returned to work. Eighteen months later, November 28, 1902, he had his second attack of hematemesis and was incapacitated for work for one month. During 1903, he suffered considerably from digestive disorders with vomiting, the matter vomited frequently containing articles eaten several days before, but showing no blood. Toward the latter part of 1903, his digestion began to improve and he gained in strength and flesh, so that by Christmas he weighed 172 pounds, a gain of 30 or 40 pounds. This improvement, however, continued for a short time only and in the early part of 1904, he again began to suffer from indigestion, vomiting almost every day, bringing up large quantities of partially digested food. There was a great deal of gaseous distension of the stomach, but very little pain. He rapidly lost in flesh and strength, but continued at his work until August 19, 1904, when I saw him for the first time, a few minutes after an atack of hematemesis in which he had vomited about 3 quarts of sour, partially digested food, containing a large quantity of blood. Examination showed great dilation of the stomach, the lower border extending 2 inches below the umbilicus. No tumor could be detected and very little tenderness was present. The bowels were moved only at rare intervals under the influence of laxatives and very little fecal matter was passed. The case was clearly one of ulceration of the stomach with marked dilation due to stenosis of the pylorus. The history of the case extending as it did, over a period of 3½ years, the rapid improvement between the attacks of hemorrhage and the failure to find a tumor, warranted the hope that the stenosis was due to cicatricial contraction following the healing of nonmalignant ulceration. The hem-

orrhage was not repeated and, in the course of 2 weeks, the patient was able to be about. Operation was advised as the only means of affording permanent relief and to this the patient agreed, but desired to postpone its performance until the winter, when he would not be able to pursue his occupation. After recovery from the effects of the hemorrhage, the patient was instructed in the use of the stomach tube and thereafter, the stomach was washed out daily. He returned to his work, but in October was compelled to give it up on account of increasing weakness and was soon confined to bed from inability to assimilate sufficient nourishment. It seemed as though nothing passed the pylorus. Operation was performed November 4, 1904. A 4 inch incision in the median line exposed the pylorus which presented as a smooth, dense, thickened ring. There were no nodules, no enlarged glands and no adhesions. The stomach wall seemed to be somewhat hypertrophied. The omentum and transverse colon being brought through the incision, the posterior wall of the stomach was made to present against the transverse mesocolon by the left hand carried above the stomach. The mesocolon was then torn through and the most dependent portion of the greater curvature of the stomach exposed. The commencement of the jejunum was next located and a point about 4 inches from the duodenojejunal fold selected, and it with the posterior wall of the stomach brought into the incision, the omentum, transverse colon and remainder of the stomach being returned to the abdominal cavity. These two points were then united by means of a large-sized Murphy button, reinforced by a continued peritoneal suture. The parts were then returned to their normal position and the wound closed. Recovery from the operation was uneventful. There was no vomiting or other symptom referable to the stomach. After 48 hours liquid diet was allowed, to which semisolid food was soon added. On the twentieth day after operation the patient returned to his home. During the 5 months since operation he has continuously improved in strength and flesh. His weight, which in November was 125 pounds, is now 165 pounds, a gain of 40 pounds. He is working every day. He is able to eat and digest all varieties of food and suffers no inconvenience from his stomach. He has vomited only twice since the operation. On both occasions the amount was small and followed indiscretions in diet. There has also been a considerable reduction in the size of the stomach. The bowels are moved regularly and freely. The button, although sought for, has not been found. It has probably dropped back into the stomach, but I have not had an opportunity to verify this supposition by an X-ray examination. It, however, has given rise to no symptoms.

In considering the treatment of pyloric stenosis, several operations suggest themselves. Digital divulsion of the pylorus as proposed by Loretta, which was the first operation performed for the relief of this condition, has now been abandoned. Pyloroplasty, while overcoming the narrowing of the pylorus, is open to the objection that in cases of marked dilation it does not permit free drainage from the dependent portion of the stomach, and also to the further objec-

tion that in many cases, the ultimate results have not been all that could be desired. Finney's operation of gastroduodenostomy in which the lower portion of the pylorus is included in the incision, would seem theoretically to be the ideal measure for the relief of benign contraction of the pylorus, as it provides a free communication in the normal position, not liable to subsequent contraction and also probably permits sufficiently free drainage. However, in cases such as the present one, in which the patient is greatly prostrated from inanition, the time required for the performance is a serious objection to its adoption. The operation which has most frequently been employed in these cases and which has given the most satisfactory results is gastroenterostomy either in its anterior or posterior form. The anterior operation while simpler of performance causes more disturbance of the position of the small intestines and does not afford the free drainage that is secured by the posterior operation. A consideration of these points led me in the present case to adopt posterior gastroenterostomy.

DISCUSSION.

DR. WILLIAM L. RODMAN: I think the case was a proper one for gastrojejunostomy and I agree with Dr. Holmes that the Murphy button still has its place in gastric surgery. I believe that it is the quickest, easiest and, in some cases, the most satisfactory way of producing an anastomosis between the stomach and the jejunum. The indications for operation in this case it seems to me were complete, and that nothing else could possibly have given the same results as have been secured by a posterior gastrojejunostomy. The operation of anterior gastrojejunostomy is passing out of use. I read only yesterday that Dr. Scudder, of Boston, who has made a round of the European clinics, said that only in the clinic of Krause is anterior gastrojejunostomy still being used. While this method is quicker, it must have only a limited place in surgery. In operations such as this, where there is no occasion for haste, the posterior operation should always have preference.

A Case of Resection of the Elbow for Ankylosis, Resulting in Excellent Movement.

BY G. G. DAVIS, M. D.

[Exhibited April 12.]

This patient received an injury of the elbow 13 years ago, when 7 years of age, by falling into a quarry. Her arm was stiff until two years ago, when it began to pain and after one week began to discharge. The dis-

charge continued for 6 months when the sinus closed, but the pain continued. The patient was seen by Dr. Hutchinson on account of the excessive pain. He freed the ulnar nerve and 2 months afterward she still complained of pain. I saw the patient at this time, when a skiagraph showed the bones of the forearm to be ankylosed with those of the arm. I made a resection of the elbow joint, and the patient is exhibited to show the results which can be obtained in an elbow which has been stiff and without use for a period of over 11 years. She is able to flex and extend the forearm to almost the normal extent and possesses a considerable amount of pronation and supination, she can do light housework and is able to use the arm in sewing.

I also show the apparatus which was applied to the forearm in order to gain motion. It consists of a leather socket laced to the forearm to which is attached a light iron bar projecting backward beyond the elbow, a light weight is allowed to hang at the back which keeps the elbow in continual motion.

An Encysted Calculus Removed by Suprapubic Cystotomy; with Specimen and Skiagraph.

BY EDMUND W. HOLMES, A. B., M. D.

[April 12.]

E. S., aged 45 years, was admitted to the Methodist Episcopal Hospital with the classical symptoms of stone in the urinary bladder. Under ethyl chlorid as a general anesthetic, the bladder was washed out with a Bigelow evacuator; and a careful systematic search made with a sound, but no stone was found. The symptoms of vesical irritation were so persistent, the patient was sent to Dr. W. L. Menges at the Jefferson Hospital for a shadowgraph. He reported the presence of a small calculus as shown in the photograph, and upon inquiry, particularly noted that taking into account the relative positions of plate and patient, the foreign body would probably not very much exceed the absolute size so indicated. I, therefore, concluded it must be encysted, and upon suprapubic section found the calculus encysted on the lower posterior wall of the bladder so that it had to be enucleated from its resting place. You will note it corresponds in size almost exactly to the black spot on the picture. It escaped detection with the sound under general anesthesia because of its complete encapsulation, the characteristic sign, of pain at the end of micturition referred to the end of penis, being present in spite of its immobility. The patient had an ankylosis of the right hip joint due to a pathologic condition of childhood you will see the thickening as compared with the healthy left femoral head. The X-ray picture is a triumph of art, from its clear definition, from its determination of the presence and actual size of the calculus, and from the exhibition of the pathologic changes around the head of the right femur.

An Enlarged Prostate Removed by Permeal Prostatectomy.

BY EDMUND W. HOLMES, A. B., M. D.

[April 12.]

Mr. T., aged 72 years, about 5 years ago had his first attack of retention of urine which required catheterization for about 2 weeks. At intervals after this he had some trouble in micturition after being chilled or being tired. In August, 1904, he had a second attack of retention which lasted for a week, when the catheterization became difficult and painful. I was called in consultation by the family physician, Dr. Partenheimer, and succeeded in emptying the bladder. In the course of 10 days I was summoned 3 times, when we warned the patient of the dangers of a catheter life, and proposed perineal prostatectomy. The operation was performed September 2, 1904, taking about ½ hour in all (31 minutes) including the time of anesthetization. With the patient in the lithotomy posture a small grooved Gouley catheter (No. x F.) was inserted, and a median incision made with a slight "y like" divergence posteriorly; the capsule of the gland was cut and with a forefinger on either side, the prostate was readily enucleated—you can see how cleanly it peeled out like a pea out of its pod—later the patient refused catheterization, the fistula remains in the perineum (8 months after operation). He has complete control over urination, the urine passing out altogether through the opening in the perineum—the only inconvenience being the sitting posture necessitated while passing his water. He is in good health, conducting a successful business. The specimen shown is probably 3 or 4 times the natural size.

Exhibition of Flutostethoscope.

BY HENRY EMERSON WETHERILL, M. D.

[April 12.]

I would like to show the Society a small apparatus which I cut out of wood and which is somewhat in the line of Oertel's stethoscope, only simpler. The object of it is to measure the amplification of sound. The principle on which it is employed is to take one finger off after another until you cannot hear the sound and in this way measure the amplification of the aortic and other valves and sounds. The roaring which has been a troublesome feature in ordinary stethoscopes I discovered is avoided by the use of a small hole. The instrument is placed in the ear as well as the tambour being on the outside of the concha, and the fingers are taken off the holes one by one. It is flutelike in appearance, and in fact, I have called it the flutostethoscope; but a more descriptive scientific name would be En-un-auricular nonroaring (wooden or metal) amplification-stethoscope.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

Two Cases of Malignant Endocarditis.

By M. H. Fussell

[Read May 10.]

The following cases are reported not only for their individual interest, but because of the lessons in diagnosis which they serve to point. Both cases occurred in the ward of St. Timothy's Hospital. I owe the opportunity to report them to Drs. Cohall and Mellersh of that hospital.

Case I. May 28, 1904. C. K., aged 15 years. Father and mother living and well; 4 sisters and 3 brothers living and well. Two sisters died in infancy. No history of tuberculosis in family.

As a child he was healthy and strong. He remembers no diseases except measles and whooping-cough and was quite well until one year ago, when he had a fever called typhoid. He was treated at home and was 7 weeks in bed. Since this illness he has not been at all well, having pains and aches over the entire body and spells of weakness.

The patient worked until one week ago, when he found that he was unable to continue on account of weakness. His bowels are very constipated. Complains of pain in stomach and limbs. Appetite fair and sleeps well. There has been a continuous loss of weight. One week ago he had severe, sudden pain in his ileocecal region, and entered for this symptom.

Patient slender, mediumly well nourished. Puffy around eyes, lips pale, soft and moist; tongue heavily coated, tip and edges red. Pupils equal, somewhat dilated. Pulsation of vessels of neck. Pulse regular, rather wiry. Heart dulness, third interspace, midsternum, midclavicular line. Apex beat fourth interspace directly beneath nipple. On auscultation there is a decided diastolic murmur, blowing in quality. Over the base of the heart the first sound is weak. the second is blowing in character. Both sounds are conducted down the sternum and also into the vessels of the neck. The lungs are normal.

Abdomen.—Great tympanites. No gurgling in the right iliac fossa. Much tenderness over the entire abdomen, but the tenderness is much more marked

in the right iliac fossa, where there is marked resistance. The lower edge of liver can be palpated and is extremely tender.

Blood Count: Hemoglobin, 55%; leukocytes, 18,560; Erythrocytes, 3,120,000.

June 1. The tenderness over the edge of the liver is still great. Tenderness over McBurney's point is much diminished. On this day the leukocytes were 6,580.

June 15. Liver much enlarged. Some bulging of left lower thorax.

June 17. The cardiac dulness is ½ inch to right of sternum, third rib, axillary line. The apex beat is in fifth interspace, ½ inch outside of nipple line. There is a loud double murmur over the aortic cartilage. There are evident physical signs of pleural effusion on the left side. The cardiac action is tumultuous. From this time on the boy gradually sank and died June 21 of exhaustion. The temperature was typically septic in character from the time of admission to his death.

At the postmortem the following lesions were found: The entire body is edematous. The abdomen is almost entirely full of bloody serum. The appendix is normal both in position and in appearance; there is neither adhesion, thickening nor atrophy of the organ. The liver is extremely large and cyanotic. The spleen is normal in size. Both pleural cavities are full of liquid. The right border of the heart is on a line with the junction of the ribs and their cartilages. The left border of the heart is in the midaxillary line. The pericardium contains about 2 ounces of a clear serum. The right border of the heart is formed by the right auricle. The left border by the left ventricle. The left ventricular wall is about one inch thick. The right auricle is somewhat dilated. The mitral valve and the auriculo-ventricular opening are entirely normal. The aortic orifice is almost occluded by vegetations growing upon and almost destroying the leaflets of the aortic valves. The postmortem appearances make it seem almost impossible that blood could get through the orifice and make it entirely clear that they are incompetent.

The particularly interesting points in this case were the following: On the day of entrance the lad was apparently suffering from some acute condition. The abdominal tenderness was extreme; the resistance over the region of the appendix was as great as I ever found in acute appendicitis. The diagnosis of acute appendicitis in an individual suffering from double aortic disease was made and concurred in by the attending surgeon. Fortunately, the judgment of the surgeon was correct, and the lad was saved a useless and probably fatal operation.

The continuance of the fever made one suspicious of the formation of pus about the appendix. But the subsidence of the local abdominal signs with the increase of symptoms and signs referable to the heart, made us sure before the death of the patient of the heart as the original seat of the trouble.

Case 2. November 20, 1904. W. F., aged 30 years.

Family History.—Father and mother, 3 sisters and 2 brothers living and well. Three brothers died in childhood, cause of death not known.

He has always been in good health. Had syphilis in 1903. Was treated for one year.

Entered the hospital with diagnosis of syphilitic anemia. On August 14, complained of pain in right arm extending from elbow to wrist. Also in right ankle. These joints were swollen. One month ago ankle and elbow were swollen. Had pain in his leg. Then he began to get short of breath. Since then he has gradually become worse and had continued irregular fever, and palpitation of the heart. Patient is extremely sallow, face swollen, teeth covered with sordes, pupils somewhat dilated, pulse quick. Belly looks swollen but is not much distended, some edema of belly wall. No swelling of inguinal, epitrochlear nor cervical lymphnodes.

HEART.—Apex-beat feebly seen in nipple line in fifth interspace. On palpation beat is diffuse and rather feeble. Dulness right edge of sternum, ½ inch to left of nipple, upper border of third rib. At aortic cartilage first sound is weak and accentuated. Heart beat irregular. At the left edge of sternum in the fifth interspace there is a very faint presystolic murmur; in the region of the apex the first sound is rather accentuated.

LUNGS.—No abnormal dulness anteriorly, no abnormal breath sounds. No abnormal dulness posteriorly except at extreme bases; where note is higher pitched the breath sounds are distant and are accompanied by rales. Liver dulness begins at sixth rib and extends to costal margin in the nipple line. Splenic dulness in anterior axillary line at sixth rib, in midaxillary line at eighth rib, and extends posteriorly to the posterior border of the scapula. The edge of the spleen can be felt below the edge of the ribs. The edge of liver cannot be felt. Legs emaciated but not edematous. The urine was always normal.

The blood counts were: November 21, leukocytes, 4,180; December 3, leukocytes, 9,078; erythrocytes, 3,360,000; December 4, erythrocytes, 3,180,000; leukocytes, 6,880; hemoglobin, 45%.

This patient came in with a history of typhoid fever, and on examination had the appearance of a case of pernicious anemia.

His temperature was intermittent, but the excursions were not great. The examination of the heart was most puzzling. The sounds were weak, the only murmur heard was extremely faint; but it was presystolic in time. This latter fact, together with the fever and enlarged spleen, inclined us to a diagnosis of malignant endocarditis, which was abundantly proven by the postmortem lesions. Unfortunately the full postmortem notes of this case have been destroyed. The following notes are made from examination of the preserved specimens.

The right heart is somewhat dilated but is otherwise normal. The left ventricular wall is thickened. Both mitral leaflets are thickened with recent very friable granulations.—the anterior mitral leaflet being thickened and overgrown to the size of a shell-bark. On one of the chordæ tendineæ there is a vegetation the size of a hazel-nut, which floats almost free in the ventricular cavity,

being attached by a very thin and feeble thread to the cord. The auriculoventricular orifice is almost entirely occluded, the vegetation extending upward into the auricular cavity. The posterior leaflet is glued firmly to the heart wall. The spleen is greatly enlarged, measuring 6 by 9 inches. On the posterior edge are 2 infarcts; and in the centre of the body is a third the size of a silver half-dollar. Both kidneys are enlarged and the seat of hypostatic congestion

Case 1 is, as I have said, of particular interest—because when he entered the hospital he had every appearance of a patient suffering with acute appendicitis. It was evident that he had a severe heart lesion, but that fact did not weigh in our minds, because there is nothing more common than a heart disease without symptoms. On entrance the symptoms referable to his heart were no more severe than might be expected in any individual with a severe heart lesion suffering from acute appendicitis.

The continuance of his fever gave suspicion, as I have said, of the formation of pus, but the good common sense of Dr. Hutchinson prevented an operation.

The second case had every outward sign of a pernicious anemia; the blood count, however, made certain that this anemia was secondary in character.

Therefore the diagnosis rested with the cause. It was only because the murmur heard was presystolic in time and because of the shape of the heart dulness and the accentuation of the first and second sounds which made the lesion pretty surely that of a mitral stenosis, that it was looked upon as organic in character. Because a functional mitral stenosis is, so far as I know, not recognized.

Case 1 with severe septic fever gave the only lesion at the aortic valve with lesions in the other organs, due only to the failing compensation. Case 2 had severe septic infarcts in the spleen with great enlargement of that organ, with a temperature chart, which, to be sure, showed distinct fever, but of mild type. The abdominal pain in Case 1 is anomalous as having heart disease as its cause. We have all seen cases of pneumonia mistaken for appendicitis, and cases are on record in which an operation for that condition has been performed, a normal appendix found, and subsequently a frank pneumonia developing. So far as my knowledge goes, however, I know of no case of heart disease which was mistaken for appendicitis.

Therefore, in addition to the reflex causes for abdominal pain, we must add heart disease.

DISSUSSION.

DR. A. E. ROUSSEL: A case of malignant endocarditis following typhoid fever is rare. I would like to ask Dr. Fussell whether at the postmortem the intestines were carefully examined for lesions of typhoid fever. Three years ago I reported 3 cases of malignant endocarditis, all of which possessed features of interest. Among them was a boy, aged 12 years, who passed through a typical attack of typhoid fever in which the clinical picture was complete. The Widal reaction was positive, and, after apparent convalescence, the fever returned. The symptoms of anemia became markedly manifest, the spleen began to enlarge and leukocytosis was marked (44,000). The diagnosis was in considerable doubt until on a certain morning the boy was found to be hemiplegic. The interesting point is that the cardiac murmurs came on late in the course of the attack. The postmortem not only verified the diagnosis but also showed the intestinal lesions of typhoid fever. At the same time I reported a case of probable malignant endocarditis that terminated in recovery. A woman, aged 21 years, previously free from cardiac disease, suffered from a miscarriage that was neglected. She was sent to the Howard Hospital with all the evidences of sepsis. The heart symptoms became prominent; murmurs appeared and disappeared. Thirty abscesses were opened, and streptococci were found in the blood. The patient recovered and is alive at the present day with an impaired mitral valve. In a large relative proportion of these cases of malignant endocarditis the lesion occurs on the right side of the heart. In Dr. Fussell's case the leukocytosis became much decreased previous to death. This I have never seen, but Neumann in the *German Handbuch* mentions its possibility. Theoretically, it is difficult to reconcile. Since the publication of my 3 cases I have one more to report, that of a gentleman, aged 48 or 50 years, suffering from chronic interstitial nephritis and an aortic regurgitant lesion. Upon his return from a trip to St. Louis he was seized with symptoms approximating those of malaria. The district in which he lived was one which might have caused malaria. For 6 or 7 weeks he suffered from daily chill, fever and sweat. During the remainder of the day he was in fair health. This continued for 6 weeks, when he suddenly complained of pain, dyspnea and attention was called to the heart. There were various irregular and illy-defined murmurs heard. The septic condition became more marked. Examination of the blood showed absence of malarial parasites, but the presence of a leukocytosis. The condition is interesting and often not recognized because of the instability of the murmurs and the marked change of the clinical symptoms.

DR. NORMAN B. GWYN: I would like to ask Dr. Fussell if he has any suspicion as to what might have caused the pain in the first case, whether there were thromboses or infarcts in the neighborhood of the appendix which might have caused it.

DR. FUSSELL: Dr. Roussel's remarks about the patient apparently having typhoid fever reminds me of one point I failed to mention, that many cases of ulcerative endocarditis are diagnosed typhoid fever. I think that point is particularly made plain in a case just now under my care. I did not report the case because an autopsy could not be obtained. The patient, a woman, was admitted to the same hospital with gonorrheal arthritis. She had a slight heart murmur which I supposed was functional in character. Her arthritis entirely recovered, and she finally died with a prolonged fever of 12 or 13 weeks' duration, irregular

in character. The special point is that on several occasions we made a Widal test which was negative. The Board of Health of Philadelphia made a Widal test which was negative; we made another which was negative. The Board of Health made 2 successive tests which gave positive reaction. Another diagnosis often made is that of malaria. The cases are constantly called typhoid fever or malaria, more frequently the latter. This depends upon the particular leaning of the gentleman who first sees the case. In regard to the pain in the first case, I was entirely at sea so far as any positive findings were concerned. There was no thrombosis in the region of the appendix to account for this pain and no local condition at all. My theory is that there was sufficient dilation of the heart to cause irritation in the region of the diaphragm and this was simply a reflex pain.

Typhoid Fever—Accidental Infection with Gas Bacillus or Bacillus of Malignant Edema—Death with Symptoms of Intrathoracic Irritation. Remarks upon Giving of Hypodermoclysis.

BY NORMAN B. GWYN, M. D.

[Read May 10.]

The following case may be of interest owing to the fatal accident occurring as a result of a very well-known and more or less simple procedure, I am indebted to Dr. Musser for permission to report it.

On November 11, 1904, W. A., aged 30 years, who had been ill for two weeks, complaining of lassitude and headache, consulted Dr. Musser. Widal reaction was positive on November 16. Spots appeared in great numbers on the abdomen. Temperature running between 104–105°. Great distension of abdomen. Spleen area and liver dulness present. Quite delirious at this date. Pulse 108–120. On November 18, pulse tension low and rate higher: hypodermoclysis ordered, and repeated every 6 hours. First under right breast, second under left breast, third into right thigh. Pulse reacted. All areas remained sore for many hours. Hypodermoclysis into right breast and left thigh at midnight on November 19. At 3 A. M. November 20, there was marked cyanosis of back and poor low-tension pulse. Very delirious. Distension and diarrhea very persistent. Some soreness over left breast and swelling over clavicle and shoulder; during the night of November 19 respirations began to rise, rapidly reaching 52 per minute, and remained high. No signs of pulmonary consolidation or edema, the breathing suggesting more diaphragm irritation: rapidity persisted all day November 20 without influencing pulse to any appreciable degree. Abdominal distension lessened after using turpentine and milk of asafetida; particularly in epigastrium, wind being brought up by way of mouth. Still delirious; some redness over left chest and distinct swelling of pectoralis major. At 10.20 A. M. of November 21, pulse began to fail rapidly, running up to 120, and becoming weak and thready.

Distinct crepitations throughout tissues of left breast. Lungs clear. Spleen dulness present, liver dulness present: lavage (600 cc. fluid from stomach). Some relief; respiration continued rapid, but patient was evidently delirious. For rest of day, pulse ran at rate of 140–180, at times not being felt at wrist. Heart sounds remained fairly strong: no evidence of pneumothorax; sounds distant, but the tissues over left base and axilla were thickened and edematous; some dulness more or less marked at base. The left breast is livid, purplish; distinct amount of air or gas in tissues and feeling as if parts of tissue were liquefied. Redness and lividity extend over clavicles. Pulse remained unaltered from 4.30 P. M. till this hour in A. M. of November 22. Patient dying at 6 A. M. Up to 2 hours antemortem, patient was remarkably clear, being in fact more conscious 6 hours antemortem than 18 hours antemortem. A second attempt, 8 hours antemortem, to perform lavage was resisted violently, the patient seeming stronger and more active than 18 hours before. A convergent strabismus developed a few hours before death, no cervical rigidity. Air (gas) could be manipulated from the soft breast tissues out through the needle hole of the hypodermoclysis. An intense odor of H_2S was perceivable on doing this and a black fluid could be expressed. This fluid, preserved and sterilized at once by alcohol, shows no blood cells but a granular debris in which can be demonstrated large bacilli resembling in shape the bacillus aerogenes capsulatus; no spore bearing forms could be seen. No culture media being on hand, this step was taken to rule out development of contaminating organisms, more particularly the hay-bacillus, the morphology of which is practically identical.

The most interesting clinical conditions in the case were: first, the sudden development of rapid heart action and rapid respiration, the continuance of the same for so many hours, and, finally, the disappearance of the toxic symptoms of typhoid, while the local symptoms of the tissue infection progressed.

We are all familiar with the increasing rapidity of pulse and respiration of fatal toxemias; in this case, however, the sudden onset and character of the symptoms were more suggestive of a pleuropulmonary or cardiac accident (such as pneumothorax). The remarkable clearness of intellect and very apparent gain in strength shown by patient in last twelve hours did not indicate a progressive intoxication.

When one is familiar with the local effects of bacillus maligni edematis or of the gas bacillus, a reason for the symptoms noted is apparent; the destructive power of these organisms is intense and gas formed in the precordial area would have but little difficulty in finding its way into the pericardium or into the pleuropericardial tissues. Only a very few bubbles of gas would be required in these regions to give rise to most marked symptoms; and we believe it seems more likely that direct irritation of the heart and pleura was taking place

than that the symptoms were due to nerve stimulation or irritation, or the toxemia of the added infection.

With regard to infections by these organisms, it may be generally said that their beginning is usually in some area of necrotic or damaged tissues, hence, the report of so many cases in mangling of extremities, in extensive burns or lacerations, in the uterus after labor, etc.: that more instances are not seen is due to the fact that the bacillus is a rigid anærobe and must get deep enough into the tissues to be away from the air before beginning to flourish. Under certain conditions, not well understood, spores are formed; and it is in such form that the organism is probably introduced into the body, the resistance of spores to ordinary methods of sterilization is too well known to need further comment, and the spores of this bacillus are no exception to the rule. Once deposited in a favorable spot growth is rapid and in tissues severely damaged, liquefaction and gas-production (the characteristic qualities of these organisms) is rapid, being apparent in from three to four hours; under less favorable circumstances from twelve to twenty-four hours or more may elapse before enough gas has been formed to attract attention. In an open wound detection and recognition may be easy; in concealed spots or subcutaneous infection extensive damage may have been done before the nature of the trouble has been suspected.

In our case the long needle used and the bruising of the tissue by the introduced fluid gave to the organism the damaged tissue necessary for its growth. The depth of the infected area, concealing its nature, did not allow us to make a diagnosis until too late. It is more than possible that free incision of the breast region might have relieved the condition, but the difficulty of completely removing these infections is well known.

The question as to the identity of the microorganism causing these infections is an interesting one; formerly, previous to ten years ago, all these emphysematous gangrenes and gaseous destruction of tissues were ascribed to the bacillus maligni edematis. The discovery of another gas producer at this time has shown us that this latter, the bacillus ærogenes capsulatus, is the organism most frequently found; its relatively rare spore-formation and absence of motility differentiate it with difficulty from the bacillus maligni edematis. I do not feel that microscopic appearance alone allows us to attempt to distinguish in our case. However, the general opinion now held by those of us who have had opportunities to study cases of emphysematous

gangrene is that the so-called gas-bacillus is by far the more commonly found organism in these conditions; and the now numerous reports of infection by this bacillus, both antemortem and postmortem, and comparative rarity of reports of infections by the bacillus maligni edematis show that many of the older records of bacterial findings in emphysematous gangrene must receive correction.

With regard to hypodermoclysis a few words may be said. We probably have all come to regard the procedure as simple, and one that is rarely followed by ill effects; in fact, much more trouble is experienced with small hypodermic punctures of certain drugs. In the past, in emergencies, little or no care has been taken in the line of sterilization in many instances; but such a happening as we have described, even where all precautions were taken shows the need of absolute cleanliness and the recognition of the possibility of serious after effects. I have once before seen a patient treated to a daily chill and temperature through imperfectly sterilized gelatin used hypodermically in the treatment of aneurism; the hay bacillus flourishing abundantly in the solution. My own idea is that "normal salt solution" should be carefully prepared in bulk (the concentrated solutions give chance of contamination in the corking and uncorking of the small bottles,) and given the pasteurizing treatment; that is successive sterilizations in an autoclave or steam sterilizer. This we insist upon for our bacterial media and know that it will spoil if not so treated; how much more careful should we be of a pint or quart of fluid to be put under a patient's skin.

The concentrated solutions on the market give extra chances of contamination in the corking and uncorking of the vials; one of these preparations was used in our case.

DISCUSSION.

DR. M. H. FUSSELL: I would like to ask Dr. Gwyn just exactly how that solution was made?

DR. GWYN: We did not use it concentrated. It was dissolved in the regulation method, one dram of the solution being used in a quart of boiled water.

DR. FUSSELL: The question in my mind is, whether the bacillus might not have been in the water rather than in the concentrated solution.

DR. GWYN: Of course, there are all chances everywhere.

DR. H. E. WETHERILL: I would like to speak of a few observations I have made in hypodermoclysis; not in reference to the infection referred to in Dr. Gwyn's paper, but in reference to the use of that instrument called the hygromed which registers the moisture of the skin, and shows when to stop the hypodermoclysis in cases of severe shock or in hemorrhage.

Report of a Case of Perineal Prostatectomy Performed with the Aid of Young's Tractor.

BY MOSES BEHREND, A. M., M. D.

[Read June 14.]

The controversy among surgeons as to the best route to approach the prostate has prompted the analysis of the above case.

It remains for the surgery of the future to demonstrate the superiority of one method over the others and make it the operation of choice.

American surgeons, as a rule, prefer the perineal route. The ardent advocates of this method are Alexander, Parker, Syms, Young and Goodfellow.

The suprapubic operation is performed mainly by English surgeons; McGill of Leeds was the first to establish the proper technique. He removed only a portion of the prostate including especially the middle lobe.

An advance over his method we have in Freyer's to whom belongs the honor of performing the radical operation on the prostate. He shells out the whole prostate as one mass or in two lobes.

Deaver, in this country, has done more to further the interests of the suprapubic operation than any other surgeon, although in his most recent work on "Enlargement of the Prostate" he admits that when the case warrants it he would perform the perineal operation.

Both methods have their advantages and disadvantages.

The most forceful arguments against the suprapubic operation are set forth by Syms.

He says the incision does not favor the best drainage, that two holes are made in the bladder, and that two pockets are made in which residual urine may rest. It is also to a certain extent a blind operation.

In the perineal operation, the greatest danger is that of infection, but the argument that the distance from the perineum to the prostate is too long, is not tenable when we use the dilatable bulb of Syms, or Young's tractor. The latter was used to the entire satisfaction of the operator.

Mickulicz also considers it an instrument of considerable utility.

Notwithstanding the above differences of opinion, equally bril-

liant results have been reported by the advocates of the two methods. As an illustration of the good result following the perineal operation the history of the author's case is as follows:

J. H., aged 75 years; born in Poland.

Family History.—Father died of pthisis pulmonalis; mother died of unknown cause; one brother died of pthisis pulmonalis; while five brothers died of unknown causes. One sister died during childbirth, and two sisters are living and well.

Previous History.—About 20 years ago the patient had malaria for over a year. He believes he has had bladder trouble for the past 35 years, but during the last 5 years the symptoms have been distressing. Never passed a catheter, but he washed out the bladder several times himself upon the advice of a physician.

Present History.—The patient was seen at intervals during the past 2 years. Throughout this time he had numerous acute exacerbations of painful and frequent urination.

Operation was advised at the first visit, but it was refused.

The patient was never without pain, and he was compelled to pass urine every hour day and night. Three months ago after the most troublesome urinary "crisis" the patient decided to undergo the operation, saying that he preferred death to the tortures of the past few years.

Physical examination revealed an old, emaciated man, medium stature, shoulders bent, hair gray.

Heart, lungs and abdomen showed no abnormalities.

The rectal examination outlined a large prostate. No cystoscopic examination was made. The urine showed considerable pus, slight trace of albumin, but no glucose. The operation was performed on April 20th. The technique of Hugh Young was closely followed.

An inverted V-shaped incision was made, beginning opposite the perineal center, the arms of the V extending to the tuberosities of the ischia.

When the membranous urethra was reached, an incision was made on a grooved staff previously placed in the bladder; the staff was removed and the tractor placed closed in the bladder, after which it was opened and traction made downward and outward. The capsules over the prostate prostate were incised and the gland shelled out as 2 lobes.

A return flow soft rubber catheter was placed in the wound to the bladder through which the latter was irrigated every 3 hours for the first 24 hours, and then 4 times a day. The gauze packing was removed on the second day; on the third day the catheter was removed.

Seventeen days after the operation the patient passed his urine per urethra.

The patient left his bed on the second day. Probably the most important consideration in the after treatment was the injection of large quantities of water.

For 2 weeks after he had left the hospital, the progress of the patient

was somewhat retarded and the result of the operation seemed doubtful, since there was incontinence of urine.

At the present time, however, there is absolutely no pain. The intervals between urination are longer, he passes urine but once at night and sleeps well.

This case illustrates several points mentioned by Freyer, Young, Goodfellow, Syms and others:

(1) Age is no contraindication to the operation. The ages range from fifty-three to eighty-five, the average being sixty-eight.

(2) The percentage of cures far exceeds the failures.

(3) The prostatic urethra may be destroyed, and still the normal function returns.

(4) The introduction of sounds is not necessary, although their passage is advisable.

(5) The remarkably low mortality. According to Freyer these cases cannot be compared to any other surgery since we are confronted with all the organic and at times malignant complications incident to the age of these patients.

The author has collected, since 1902, 176 cases of perineal prostatectamy with a mortality of 2.27 per cent. and 197 cases of suprapubic prostatectamy, with a mortality of 9.8 per cent. I wish to express my appreciation for the assistance of Drs. Wm. H. Teller and V. A. Loeb.

Cervical Rib with Resulting Gangrene of the Fingers.

BY W. WAYNE BABCOCK, M. D.

[Read June 14.]

In the embryo, rudimentary elements of ribs occur in the cervical, lumbar and sacral regions. In mammals these embryonic rudiments of ribs ultimately fuse with and help to form the transverse processes of their respective vertebræ, while in reptiles many or all of these elements proceed to the formation of true ribs. In man accessory ribs anomalously develop in the lumbar and cervical regions. The former are usually short, are attached merely to the transverse process, but have no head or articulating portion connected with the body of the vertebræ and are without clinical importance. Cervical ribs are more common, and may, as in the case herewith reported, be

of great clinical importance. Normally they are represented by the anterior portions of the transverse processes of the cervical vertebræ. When a distinct rib is formed it usually shows a head, neck and tubercle, properly articulating with the seventh, or more rarely with the sixth cervical vertebra. The rib may extend scarcely beyond the transverse process of the vertebra or more rarely, it may extend forward a varying distance and have a free end, or it may pass to the first true rib to which it is attached by an osseous, cartilaginous or fibrous union. In rare instances the rib joins the manubrium through the intervention of a costal cartilage. In about two-thirds of the reported cases the condition was bilateral, but the association of cervical and lumbar ribs in the same person seems to be unknown. The socalled bicipital rib may result from the fusion of the anterior part of a cervical with the first dorsal rib. It is only in very rare instances that more than a single cervical rib is found upon one side of the neck. The intercostal space below the better developed cervical ribs contains intercostal muscles and the close attachment of the pleura usually renders it difficult to extirpate the anomalous rib without opening the thoracic cavity. The scalenus anticus muscle may be attached near the termination of the accessory rib, and the scalenus medius is at times inserted into both the cervical and the first true rib.

Clinical symptoms may result when cervical ribs project well forward, especially from those which are attached to the first true rib, and result from mechanical disturbances of the subclavian artery or brachial plexus. The symptoms may develop at any time between the age of thirteen and sixty years, but are especially prone to appear about the time of adolescence. It has been thought that cervical ribs do not develop until after childhood or early youth, but we believe it more plausible to consider that in most cases, at least, the rib is present from birth and that the symptoms result from the increased size or the greater fixity of the rib. It may be recalled that centers of ossification appear in the cartilaginous tips of the transverse processes of the vertebræ at puberty, while ossification of the processes is not completed until about the age of twenty-five. Similarly centers of ossification appear in the head and tubercle of normal ribs at fifteen, while fusion with the rest of the rib occurs at about the age of twenty-three. It is obvious, therefore, that a cervical rib will tend to become progressively larger, more fixed and have greater tendency to cause pressure symptoms between the ages of fifteen and twenty-five

years. Moreover, as indicating that the rib is preformed, we would note that these anomalous ribs are symmetrical in structure and do not resemble aberant osteophytic outgrowths, and they show muscular attachments that hardly would be contracted at the age of puberty. In the majority of cases reported no symptoms from the accessory rib were noted, but the condition was discovered accidentally in the dissecting room, in the clinic or upon X-ray examination. In the neck, the elevation of the subclavian artery as it winds around the anomalous rib may produce a pulsating fulness that may be mistaken for aneurism. The chief symptoms are those of circulatory weakness with a greater or lesser degree of ischemia of the hand and arm. There is wasting of the muscles, pallor, marked susceptibility to cold, diminished temperature, and in rare cases a slight terminal gangrene of the fingers. Complete paralysis has not been reported, but frequently there are grades of paresthesia with numbness, tingling, neuralgic pain, diminution of electric excitability of nerves and muscles, and decreased motor power. As a rule, the condition tends to become progressively worse, although the symptoms may be ameliorated by warm weather, by massage, by position of the arm and other local measures. The radial and ulnar pulses, and at times that of the brachial artery may be much diminished or absent. As a rule a rapid disappearance of symptoms follows the excision of the rib provided injury to the brachial plexus or large vessels does not occur during the operation. While it is generally advised to remove the periosteum with the rib to prevent its regeneration, cases in which a return of symptoms has resulted from regeneration of the bone do not seem to have been recorded. As to the mechanism of the ischemia Murphy has emphasized the importance of the compression of the subclavian artery between the growing rib and the resisting scalenus anticus muscle. In a number of the reported cases, however, an enlargement of the vessel as it winds around the cervical rib, and after it leaves the interspace between the rib and the muscle, has been noticed, and from the study of the case herewith presented we are impressed with the possibility of a circulatory inefficiency, not from compression, but from the retardation of current due to the angulation of the vessel. Normally the subclavian artery passes obliquely over the first rib from within forward and outward in a nearly straight line, and is continued as the axillary artery in a gentle curve. The cervical rib which is always present to the outer side and below the artery tends to cause the artery to pass over the first true

rib nearer to the sternum and in a more transverse direction, thus producing two rather sharp curves—the one as the artery winds around the scalenus anticus, and the second as it winds around the anterior portion of the cervical rib. A third curve with possibly also some compression is also produced by the passage of the artery from a higher level than normal under the clavicle at a place where the clavicle is in closer proximity to the thorax than it is at the normal line of the artery. While in certain reported cases it was found that elevation of the shoulder and arm relieved the pain and that patients could sleep best when the arm was above the head, in the present case the greatest relief was afforded by making traction upon the arm while it was in marked adduction, the shoulder being somewhat raised, and the head flexed toward the affected side, a position which would give the subclavian a more transverse and less oblique course across the first rib and would tend also to lower the position of the artery below the clavicle. As indicating that angulation of the artery and not compression may be a rather common cause of the circulatory disturbances resulting from cervical rib I suggest the following points:

(1) Ligation or continuous pressure of the subclavian usually results in the rapid formation of a collateral circulation, while in the ischemia resulting from the presence of a cervical rib there seems to be no tendency toward the formation of a collateral circulation.

(2) Compression of one of the larger vessels of the neck usually produces a bruit which is here absent.

(3) The aneurismal enlargement or widening of the subclavian external to the rib are not in accord with a proximal point of compression.

(4) In the present case the brachial pulse was well marked, although weaker than that of the opposite side. The radial artery was palpable but pulseless, conditions consistent with an angulation or tortuosity of the subclavian so cutting down the heart impulse that an oscillation more than a distinct onward impulse of the blood was produced in the terminal vessels.

Venous disturbances do not result from cervical rib alone. The subclavian vein passes to the outer side of the scalenus anticus muscle and so is not exposed to pressure. Upon the other hand edema or other form of swelling in the neck and exostoses upon the first dorsal rib often produce venous compression and resultant edema of the hand and arm.

The diagnosis may be easy or difficult. In the present case the

presence of a cervical rib was only clearly mapped out after repeated palpations. The coexistent deformity of the spine rendered it difficult to distinguish between accessory and normal ribs in the skiagram. Progressive circulatory changes in the hand or arm increased by cold, unassociated by edema, and associated with some form of paresthesia, are symptoms strongly suggesting cervical rib.

The history of the present case is as follows:

A. V., aged 22 years, unmarried, farmer, is the third of a family of 8 children, 2 of whom died during infancy while those remaining have had good health, except one brother who has had abscesses involving the side of the neck. His mother has suffered from rheumatism, heart trouble and edema, but is now in fair health. His father is living, at the age of 50, and is in fair health except for a weak back.

Previous History.—The patient has always been sickly. At 9 he had a protracted attack of scarlet fever, and has had measles, mumps, varicella and repeated attacks of influenza. Until he was 18 he was subject to a severe winter cough. From the age of 10 he has done laborious farm work. Two years ago he developed an eruption over the abdomen apparently without local sore, adenopathy or other constitutional symptoms. For this he was given mercurial inunctions. Several months ago an abscess developed in front of the trachea which was incised and healed, to later break down into a sinus after a traumatism. A fistula discharging a small amount of watery pus has remained just below the cricoid cartilage.

Present Illness.—At 13 the patient noticed a stiffness of the neck and a tendency to carry his head to the left side. During cold weather the right hand became pale, cold and benumbed. He would wear 2 pairs of mittens on his right hand, yet the cold would produce a dull, aching pain, and prevent the use of the fingers, although the bare left hand would be uninfluenced by the cold. In summer the hands seemed nearly equally useful, but during the winter the entire right arm seemed weaker than the left. Two years ago, when the patient was 20, while doing heavy work the tip of the middle finger of the right hand became abraded and refused to heal under various applications that were made. About one year ago a part of the terminal phalanx became black and gangrenous. During the past winter the tips of the ring and little fingers of the right hand also began to show trophic changes. In October, 1904, the pain in the hand became so severe that he could not sleep at night except for short periods of time. The pain was dull and felt to him as though the bone were being pulled out of the finger. Slight relief was obtained by making traction upon the hand with the arm in adduction. The hand was practically useless and quite tender on pressure. The pain was increased by raising the elbow. During the past winter he did heavy farming, but was able to use but one hand. The pain seemed more severe at night and during the week preceding his entrance to the hospital he was obliged to walk the floor at night. The condition was thought to be a result of frost bite. Through Dr. J. P. Dalby, of Gettysburg, and Dr. J. W. Croskey, the patient

came to the Samaritan Hospital early in April. Examination showed a poorly developed, prematurely aged man. The distal phalanx of the middle finger of the right hand was gangrenous to the matrix of the nail, the bone was exposed and dry, while the surrounding tissues were grayish black, and there was no evidence of active inflammatory reaction. The tips of the third and fourth fingers showed stellate atrophic depressions without ulceration. The hand was pale, cold and thin, was tender on pressure, and after pressure the return of color required 2 or 3 times that required for the opposite hand. The entire arm was smaller than the left. No radial or ulnar pulse could be made out, although the radial artery was palpable as a small cord. A pulse was felt over the right brachial artery, less forcible than that of the left. The subclavian artery was more readily palpable on the left side apparently from its higher position in the neck. The pulsations of the carotids were nearly equal in intensity, the left being possibly somewhat stronger. There were no adventitious sounds. The right side of the face was more sunken and seemed less developed than the left. Anteriorly, the chest was flattened and narrowed. Posteriorly, the right scapula was unduly prominent. There was a marked scoliosis to the right in the lower cervical and upper thoracic regions. A small sinus with seropurulent discharge, and pale, flabby granulations was present in the median line of the neck, just below the cricoid. Running from the right lateral aspect of the seventh vertebra downward and forward, to pass under the clavicle near the junction of the inner and middle thirds, a deep lying bony rod was felt on very careful palpation. The patient tended constantly to assume a position with the head inclined to the right side, the shoulder elevated and carried forward, the arm pulled downward and carried close to and across the body.

Operation.—April 8, 1905.—Ether anesthesia. Transverse incision above right clavicle. Brachial plexus retracted out and up, subclavian artery down and in, exposing the termination of a cervical rib. It was found to expand at its junction with the first true rib, forming a very firm, bony union. The rib was divided near its centre, but its terminal attachments were so firm that it could not be mobilized. It was therefore separated from the first rib with the accompanying bony expansion by a large burr revolved by a surgical engine, and the lower half of the rib removed. The upper half of the rib was removed back to the transverse process by means of gouging forceps. The subclavian artery seemed rather small and adjacent portions of the first rib were freely removed to give it ample space.

After History.—The day following the operation severe throbbing and burning pain developed in the right hand, and the hand became red and warm. The third night the patient was able to sleep without an anodyne for the first time for several months and the pain in the right hand had almost entirely disappeared. Ten or twelve days after the operation a faint radial pulse was perceptible.

I am indebted to Dr. Dalby for the report of the patient's condition two months after operation. There was considerable improve-

ment in the circulation of the right arm. The radial pulse was distinct and of fair volume, although not as good as the left. The tips of the third and fourth fingers became calloused and fell off, leaving healthy tissue. The gangrenous tip of the middle finger sloughed off and a healthy stump remained. The general physical condition was not good, and the sinus above the suprasternal notch persisted. In this case it would be interesting to know whether the marked scoliosis has been a result of the patient's attempt to relieve himself of the pressure of the growing rib. This seems not unlikely. The history is a very typical one of a severe type of symptoms resulting from cervical rib.

Exhibition of Cases.

BY WILLIAM L. RODMAN, M. D.

[June 14.]

Case 1. GOITER.—A young woman, aged 22 years, suffered for the last few years with dyspnea, difficulty in swallowing, and some evidence of congestion about the brain from pressure on the vessels of the neck. The tumor extended up to the angles of the jaw on both sides and well down into the mediastinum. It was partly cystic and partly solid. The operation was the collar incision of Kocher. There was slight hemorrhage and the patient left the hospital in a week.

Case 2. SUPRAPUBIC CYSTOTOMY FOR CALCULUS.—The patient is an elderly man, and the 2 interesting points in the case were that although there was quite a large stone in the bladder it was not located by the X-rays. The stone was there, nevertheless, and was removed. Another interesting feature in connection with the case was rupture of the distended bladder, an accident which I have always feared might occur, especially in distending the urinary blader after long contraction from cystitis. The rupture occurred into the prevesical space. I have always thought this danger was exaggerated by the books. I have done many suprapubic cystotomies and have not before had this accident occur. Fortunately it was in the prevesical space and the opening only a trifle lower than it would have been made. The opening large enough to admit a sound enlarged and the calculus was removed through it. Drainage subsequently was perfect and his recovery has been uninterrupted.

Case 3. ENTEROANASTOMOSIS FOR CARCINOMA OF THE CECUM.—The patient is 55 years of age, and there were numerous small cancerous growths in the intestines, omentum, etc., as well as a large cancerous mass in the cecum. There were symptoms of intestinal obstruction for a week or 10 days previous. At the time of operation the symptoms of obstruc-

tion were complete and the patient vomited feces for a day. When the abdomen was opened I found that radical operation was out of the question. The only thing to do was to make an enteroanastomosis of the distended ileum above with the ascending colon below. The ileum was so much distended that when it was forced out of the abdomen I thought it was the stomach. By anastomosing the ileum and colon by means of an opening 3 inches long by direct suture the symptoms of obstruction were relieved and the operative recovery was perfect.

Case 4. PERFORATED GASTRIC ULCER.—This patient was a young man, aged 22 years, who had had ill-defined symptoms of dyspepsia for a year or two, but at no time were there the classical symptoms of ulcer. He had not vomited and had no great amount of pain after eating. Gastric ulcer was not suspected by his physician, Dr. Page, on this account. After eating very freely in the middle of the day of milk and other things he was seized with profound colic and shock at 4.30 P. M., and was taken to his home. He was seen at 6 o'clock by Dr. Lowenburg, who recognized the condition. Dr. Page and I arrived there at 7 o'clock, and we concurred in the diagnosis of a probable gastric ulcer which had perforated. The abdomen was opened at 9 o'clock in St. Joseph's Hospital, and an ulcer was found on the anterior wall of the pylorus. There was an opening in the ulcer almost large enough to admit the little finger. It had been covered by omentum and consequently there had not been at the time a great amount of extravasation, which decided me to mop instead of irrigate. The opening in the stomach was closed by two rows of Lembert sutures and the stomach further protected by abundant iodoform gauze packing. As a result of the extravasation there was a furious peritonitis, and the patient was violently maniacal. On one occasion, 48 hours after operation, it was necesary to restrain him, as he walked all about the room. He vomited copiously and frequently, the character of the ejecta being very dark. We thought he could not recover. He did, however, make a satisfactory recovery. The interesting feature in this case was the absence of symptoms pointing to gastric ulcer and the fact that rupture took place in connection with a latent ulcer, as is not infrequently the case.

Case 5. POSTERIOR GASTROENTEROSTOMY FOR ULCERS.—This patient has been operated upon for appendicitis and also for an injury to the leg. I saw him first last fall and made a diagnosis of gastric ulcer. I would have operated at that time but found hyaline and granular casts in his urine. His kidneys were in such a condition that I considered the propriety of an anterior operation under cocaine. He was under my care several months before the operation. After getting his kidneys in better condition by the use of diuretics, especially Poland water, I was willing to give chloroform and do a posterior gastroenterostomy. The lesion was found to be due to 2 old ulcers at the pylorus, one on the anterior wall and one on the posterior. The posterior ulcer extended well down into the duodenum. Around the old cicatrices adhesions had formed and the pylorus was not very patent, which explained why there would be absence of vomiting for days, and again copious vomiting. The stomach was quite dilated. He vomited but once following the operation. This was 5 days afterward

when, on account of intense hunger, he surreptitiously ate an orange—pulp, seeds, etc. He has gained from 10 to 15 pounds in a month. All gastric symptoms have passed and the kidney condition is much improved.

In the technique of the operation the loop was entirely eliminated. Mr. Moynihan has advised making the anastomosis 9 inches from the beginning of the jejunum. This makes possible the danger of a vicious circle; but, by eliminating the loop and making the anastomosis 2½ or 3 inches from the beginning of the jejunum I have not found any case followed by a vicious circle.

Case 6. GASTROENTEROSTOMY FOR CARCINOMA.—A man, aged 55 years, began to complain of dyspeptic symptoms last September for the first time in his life. At that time he weighed 190 pounds. When I saw him in the Medico-Chirurgical Hospital about 6 weeks ago he weighed 117 pounds. He would not vomit for 2 or 3 days, and then would vomit copiously the characteristic coffee grounds material. There was a palpable tumor, and notwithstanding the fact that lactic acid was not present the diagnosis of carcinoma was unhesitatingly made and gastroenterostomy advised. The abdomen was opened and the lesser curvature from the pylorus to the cardia was filled with carcinomatous material. The pylorus was almost closed. The patient had been seen by Dr. Thrush and the condition rightly diagnosticated. The same method of procedure was followed in this operation as in case 5, eliminating the loop and making the anastomosis by direct suture. I always use the clamps. An opening at least 3 inches was made in the stomach and the duodenum. The gentleman has been absolutely relieved, and in the last month has gained 25 pounds. He has not vomited since the operation. The temperature has never reached 99°, and he left the hospital in 2½ weeks.

The case further shows that we should not depend upon the chemical findings. If we wait for lactic acid and the presence of the Oppler-Boas bacillus and other findings our intervention will be too late. No operation can be more satisfactory than posterior gastroenterostomy in dilation of the stomach due to stricture of the pylorus.

Rectouterine Fistula.

BY L. H. BERND, M. D.

[Read June 28.]

Mrs. S. was referred to me at the Italian Hospital, April 5, 1905, with the following history: She was 33 years of age; married; housewife. She had given birth to 8 children, 3 of whom were still living. She had had 5 miscarriages, otherwise she had never had any trouble.

Her present trouble started 5 weeks ago when she aborted a 3 months' fetus. She was curetted by her family physician at that time.

Examination.—Woman very pale and thin, complains of headache,

backache and a feeling of uneasiness in the lower part of the pelvis; also a bloody, fetid discharge. The perineum is lacerated through the external sphincter. Has a slight cystocele and a large rectocele. No visible discharge, the patient having taken a douche. A unilateral laceration of the cervix is felt and the uterus seems slightly adherent to the rectum. Fundus enlarged and soft, tubes and ovaries in good condition and not markedly tender. Through a speculum a peculiar blood-stained discharge is seen, which has a putrid odor. Temperature, 99°; pulse, 88.

The patient was prepared for operation in the usual way. As she was being put on the table, the nurse informed me that the fluid from the enema came out through the vagina. Careful search under ether elicited no opening from vagina to rectum.

An enema of milk was then given. The milk came out through the cervix. A sound passed into the uterus came in contact with the finger in the rectum through a small opening about ½ inch above the internal os. A very gentle curettage was done and the uterus packed with iodoform gauze. The cervix and perineum were then repaired. The packing was left in 48 hours. The bowels were moved on the sixth day by an oil enema. The recovery was uneventful. Menstruated on April 18.

June 15, 1905. The patient came in and seemed well except for an adhesion of the uterus to the rectum. She thinks she is about 2 weeks pregnant.

The case is rather unique. Rectouterine fistulæ are not mentioned in several of the text books on Gynecology. Guilliame mentions the possibility of such cases.

Carcinoma sometimes causes them, also tuberculosis. This case was probably due to trauma. In this particular case, as the injury was so low, the danger of infecting the peritoneum was greatly decreased. It is possible that the uterus was adherent from a syphilitic condition and the curette had slipped through at that point. My idea of syphilis in this case is due to her history and the syphilitic condition of one of her children. The husband also has rather a suspicious looking nose, while he denies most emphatically any disease of that kind. The patient is now three months pregnant.

DISCUSSION.

DR. J. COLES BRICK: Dr. Bernd well states that such cases are very rare. Indeed, the only one successfully operated on for congenital fistula between the rectum and uterus is reported by Bodenhamer. There are two rectal conditions in which a congenital rectouteral fistula may exist: first, where there is arrested development of the rectum, the only opening being into the uterus; and second, where the rectum and anus are normal and there is a rectouteral communication. The latter appears to be the condition in the case reported by Dr. Bernd, although, instead of being congenital, it was probably traumatic and specific. I saw a child

aged 3 months recently in the rectal department of Jefferson which was somewhat similar. There was no anus, and the rectum opened into the vagina near the uterus. In this case the opening was patulous instead of being a small fistulous tract, as is usual in such cases as that of Dr. Bernd. In my case, operation was postponed for from 3 to 5 years. The prognosis in rectovaginal fistula is favorable; Morgagni's patient lived to be 100 years old, and raised a family of children

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Some Aspects of the Cancer Problem.

BY G. BETTON MASSEY, M. D.

[Read May 10.]

The first step in the solution of a problem is a full realization of the pressing nature of that problem. That this step has been taken in connection with the cancer problem is evident from the widespread interest in the subject shown by the recent medical literature of all countries. In America we owe this awakening to Dr. Roswell Park, whose prediction concerning the increase of cancer in this country, made some years ago, is in a fair way to be verified by the facts. In Philadelphia, for instance, the ratio of cancer deaths to the population has increased from 314 per million in 1861 to more than 700 per million in 1904.

With 1,037 deaths from cancer in this city during the past year, we must have had at least three thousand persons suffering from this affection during the same time—a most appalling state of affairs. The mere statement of such figures, which are paralleled and even exceeded in other portions of the country, should arouse to renewed effort a profession whose practical relation to the subject is illuminated by the broadest altruism.

The aspect of the cancer problem that I will briefly review this evening will not include a discussion of recent investigation into the nature of these affections. The time has not yet arrived for any but the research workers themselves to estimate the results attained. My remarks will be confined to ascertained facts and accepted views alone, in the belief that we are already possessed of more information in the premises than is generally acted upon.

I shall therefore speak briefly of (1) *the importance of a wider diffusion of our present knowledge concerning cancer.* Though there is much yet to learn concerning this affection, even possibly its true

nature, and certainly the method by which it attacks its victims, yet we are in possession of most important information of a definite character concerning it. That much of this information is totally misunderstood by the people, to their dire disadvantage, is evident by their total disregard of its cardinal points. We know, for instance, that cancer is purely local in its first manifestations, and that the only constitutional feature present in this curable stage is a possible nonimmunity to it. That this fact is not understood by the sufferers themselves is evidenced by general disregard of the early manifestations of this disease—a disregard and misconception that must be shared by some misguided physicians themselves who have given the advice "Don't touch a cancer until you have to"! I do not believe that any physician should be guilty of this ignorance at the present day. It remains a fact, however, that a former ignorance on this subject has been most unfortunately absorbed by the general public. It should be our duty to enlighten the people on this point, whether we were formerly responsible for such errors or not, and urge the scientific value of the earliest destruction of suspicious nodules, and the deplorable results of a policy of delay, permitting a general diffusion of what was at first a strictly local malady until it is changed into a general infection.

We should inform the public that all painless, growing nodules are suspicious nodules, and should be submitted at once to the scrutiny of a physician. The common belief is that nothing can be cancerous unless painful—an unerring evidence of a disregard of all stages of these growths but the last one.

We should also do all possible to dissipate any tendency to ostracise these sufferers by assuring the public that all scientific testimony is against the possibility of the ordinary means of infection spreading these diseases.

(2) *Who is responsible for the present neglect to inquire into the causes and methods of prevention of cancer?* The opportunity to serve mankind in establishing the cause and proper means of prevention of cancerous affections will most likely be the lot of a member of the medical profession—that body of men whose daily work itself sows the seed of altruism in the heart of each individual member, if he be not altogether absorbed in love of self. In spite of this probable fact, it is an error to assume that the public may safely wait with folded hands until some brilliant physician, without special assistance, discovers the cause of cancer. Research of this nature has no possible

means of remuneration within itself, and the hope for the glorious result will not pay the living expenses of the devotee, who is, apparently by an economic law of human effort, invariably poor. If the general government maintains a meteorologic service for the problematic prediction of weather conditions; an agricultural department for the benefit of the farmer; a most extensive service for the benefit of the mariner; nay, even an army and navy for the general defense—surely it should provide the living expenses of workers and the other costs of a research into the cause and prevention of this affection, with its increasing menace to the life of the citizen. Such, indeed, is the need, uncertainty of results and importance of this work, that state governments should establish additional and independent laboratories of research, while the field would not be crowded if a score of financial giants each endowed an institution for this purpose.

The responsibility for this work is therefore in the hands of the public itself, and can be transferred to professional hands only with the provision of ample means for its prosecution.

(3) *What positive and negative indications for treatment have we at present?* The history of medicine records many instances in which an efficient remedy has been applied to a disease long before the true nature of the disease has been understood. Striking examples of this are the discovery of the value of cinchona in malaria four hundred years before the exact nature of this affection was understood, and the discovery of the value of vaccination one hundred years ago while the germ of small-pox is still under judgment.

Whatever the true nature of cancer, we can positively affirm that nearly one hundred per cent. of external and semiexternal cancerous growths can be positively cured in their early stage by the destruction or removal of the original nidus of the disease. This cannot be said with equal truth of many affections regarded as trifling ailments, yet whose course can only be watched and assisted.

Such is the curability at its inception of these growths that the appearance of one on the body surface should be likened to the arrival of a ship infected with cholera at the maritime port of a country. The general system of the patient may be as surely protected from its dissemination as the country is protected from cholera by the disinfection of the ship and the isolation of its passengers.

Early and complete destruction of the primary growth is then the scientific remedy for cancerous growths, and if this simple plan be followed at the right time the need for the discovery of an effec-

tive toxin for vaccination, or of an antitoxin for combatting the disease, will be confined to internal primary growths alone—a very small proportion of the whole—for, to turn to a homely illustration, what practical gardener would care to inoculate his garden with a weed toxin or antitoxin when the patch of weeds is so small and circumscribed that he may pluck them out at once, root and branch? Even the deterrent action of the X-rays would be unnecessary if the aroused sense of the public would bring these growths under treatment in their earliest stage.

Early removal or destruction being so effective, it is our duty to ascertain why so few sufferers present themselves in this stage. The fact that they go to the quacks and irregulars shows that a belief in its constitutional nature cannot account for all the neglect of early treatment, for the quack methods are usually of a purely local character. The obvious answer is that curettage and enucleation of these growths have been failures because these procedures permit a reimplantation of the cells or germs in the disturbed edges and open lymphatic vessels, while complete and wide removal is dreaded as too severe an operation, in spite of the fact that this is the only time at which it is an effective cure.

That a wide-sweeping knife operation may cure one of these small cancers on the surface, and is, therefore, a scientific procedure, is unquestionably true; but the attitude that neglects the value of cauterization, particularly the electrochemical methods of destructive sterilization, and clings to the knife as a panacea is anything but scientific.

It is the writer's belief that if a more judicious use were made of the cataphoric, or electrochemical method in these early and small growths a very large percentage would be permanently cured, and without pain or material scarring, while the exercise of a wide discretion in the choice of remedies suited to the case would invite earlier resort to treatment by these sufferers, thus additionally increasing the percentage of cures.

Finally, no physician should attempt to handle these cases unless he determines to apply to them the most earnest and painstaking care. To merely operate on such a case and then lose sight of the patient is reprehensible. At the American Oncologic Hospital we have adopted the rule that all patients discharged apparently cured must return weekly for inspection during the first six months and monthly thereafter for a year, whenever possible. By this constant

oversight the earliest sign of a possible recurrence is noted and promptly destroyed, enabling us at times to snatch a brilliant success from what would otherwise have been a lamentable failure.

DISCUSSION.

DR. L. J. HAMMOND: I would like to ask upon what basis Dr. Massey founds his first proposition, that carcinoma is primarily a local disease? For, as Dr. Henry W. Cattell remarks, "In the present state of our knowledge as to the etiology of carcinoma, I consider it unwise to make the dogmatic statement that this disease is a local one. An interesting series of articles upon this subject has been recently appearing in the *Berliner klinischer Wochenschrift*. Orth, who occupies the chair of pathology in Berlin, formerly held by Virchow, concludes after two lengthy articles which appeared in the March 13 and 20, 1905, numbers of the above journal, that (1) in order to have a carcinoma one must have carcinoma cells, and without these there can be no metastases; (2) in order to explain a metastatic growth nothing further is necessary than multiplication of these cells; (3) there is no analogy in such cases to metastatic abscesses, tuberculous formations or infectious granulomata; (4) cases of successful transplantation from one animal to another may be explained without the presence of parasites but by the cells themselves; (5) no proof of a parasite being the cause of the disease has yet been brought forward. Should such exist there must be a special parasite for each of the various forms of carcinoma" (*Medical Notes and Queries*, May, 1905). In discussing this question one must make a sharp distinction between a superficial epithelioma of the skin and a tumor such as a malignant deciduoma. In the first instance the disease may be cured by X-rays, by surgical interference, or even disappear spontaneously. In one sense, every disease may be considered to have a theoretic local origin for it is an original multiplication of one bacillus or one cell, which may be considered the starting point of the disease; but as carcinoma may appear primarily in several different parts of the body at practically one and the same time, and as carcinoma of one breast may be associated with or immediately follow carcinoma of its fellow, there would seem to be in certain cases of carcinoma a disposition for the disease to recur no matter what is done for the patient. I agree with Dr. Massey as to the wisdom of establishing research laboratories for the study of carcinoma in its various aspects. Great strides in this direction have, however, recently been made, and there are no less than eight elaborate investigations going on in America and abroad having this object in view. The estimated expense incurred by this line of investigation being over $100,000 per year, and this does not include many lines of work carried on in hospitals, in teaching institutions and by private individuals.

DR. HENRY BEATES: Dr. Massey has touched upon some points about which the possession of definite knowledge can be claimed, and others that are far from having been definitely solved, and about which, from our present state of knowledge, correct conclusion is impossible. Doubtless, there is a growing tendency, and well founded, for the belief that there are certain types of carcinoma which are primarily local. Certainly, those whose opportunities for adequate clinical study render their opinions reliable, are correct in entertaining a

conviction that there are types of carcinoma which, if diagnosticated in their very earliest stage, and subjected to skilled radical operation, are cured. Hence, it must be accepted as a fact that carcinoma is primarily local. I would like to ask Dr. Massey upon what basis the claim is made, and whether it is proven that cataphoresis is as reliable and safe, or as advantageous, as early operation of the thoroughness and skill mentioned? Have there been those complete histologic studies of carcinoma, which can be accepted as proof of the value of cataphoric treatment commensurate with the claims made? I confess to what might probably be regarded as a prejudice against this treatment in comparison with proper surgical procedure, and would like, therefore, to be disabused of any unjust attitude toward facts, and hence ask the question. The rule of the Oncologic Hospital, by which they keep patients treated under observation for 1 year, is not sufficient to establish data, upon which any reliance or scientific value can be placed, because it is the experience of everyone having had ample opportunity of observing, that after relatively early operations for carcinoma, apparently complete immunity is frequently observed for as long as 7 years, when the difficulty again returns. This is a fact, and, therefore, to make a claim of cure, based upon a test of only 1 year's absence of recurrence must be, for self-evident reasons, thoroughly unreliable, misleading and indeed harmful.

DR. MASSEY: I did not think that any surgeon doubted the primarily local nature of carcinoma. One class of thinkers believes that the disease is a change in the character of cell life, unconnected with external conditions. If that were true, it would be difficult to say that a growth were primarily local, even if it did appear in one spot only; but the great majority of thinkers on this question do regard the growth as a foreign invasion of the body which may ultimately become general through regional infection of the lymphnodes, and general dissemination, but in early stages strictly local. Considering such to be the case, there has been a terrible amount of delay in the treatment of this disease. Patients come to us after 3 or 5 years of absolute nonaction, keeping under their skin a foreign growth as dangerous as if they were shut up in a cage with live carnivora. They think it yet early because the growth has not ulcerated. This emphasizes the need of our inquiring into our own opinion on this subject of the primarily local nature of carcinoma. To observe a case for a year after local destruction and removal of the disease does not, of course, carry out the well-known requirements; 3 years is the more usual period; but I emphasized the fact that for one year these cases were ordered to return weekly and monthly for inspection, and a patient who has attained that habit will continue it longer. The opinion that cataphoric destruction of these growths is effective is not based upon the recent work of the hospital. There are patients living now that were treated by this method in 1894, notably a case of sarcoma of the palate. Unfortunately, this man had a recurrence because he lived at a distance and did not come back for inspection and treatment. The ease with which one can return for treatment by cataphoresis is one of the special points in its favor. Had the man returned as he should, he would have been well long since. Patients have died at the end of 7 years from other conditions without recurrence of the carcinoma, and there is at least one man in the city who was shown to the County Medical Society, in 1899, who remains well. This was a sarcoma of the upper jaw, and he has required 2 series of applications in this period to prevent recur-

rence. He is now in perfect health. Each year, except the last year, there has been an attempt at recurrence. Other patients shown to this Society at various times remain well, with one exception, in which the disease, in an inoperable breast case, recurred in close proximity to the vessels and nerves in the subclavian region and resisted further treatment.

A Note Upon Anorexia in Infants in Hot Weather.

BY MAURICE OSTHEIMER, A. B., M. D.

[Read September 13.]

During several summers my attention has been called to a condition of simple anorexia in infants. Babies, always under two years of age, seemingly in good condition, suddenly or gradually begin to lose appetite, without even slight symptoms of gastrointestinal derangement.

These infants, for no apparent cause, refuse to take over half the usual bottle. When this condition persists, they naturally lose weight. Cases with diarrhea or vomiting, or other, even mild symptoms of gastroenteritis are not included in this class. These infants simply refuse to take the proper amount of nourishment.

Whether observed in private practice or in the hospital, each of these cases seems a separate puzzle. To find a cause for the loss of appetite, when there are no symptoms, is very difficult. It can hardly be organic; it must, therefore, be considered as a functional derangement of the gastrointestinal or probably of the intestinal tract, more properly. For some unknown reason food which has so far been digested easily begins to pall; or the intestines can no longer assimilate the quantity usually digested without difficulty, and so the infant no longer will ingest so much. A. H. Wentworth, in a recent article (*J. Am. Med. Ass.*, August 26, 1905, page 579), considers a somewhat similar etiology for infantile atrophy.

The first time that this condition came forcibly to my notice was in August, 1903. A splendidly healthy baby of eight months, with a clean family history, living in an ideal spot in the country, with excellent attention, including a trained nurse, suddenly refused to take more than four ounces of a mixture which had agreed with her for four weeks, consisting of 4 per cent. fat, 7 per cent. sugar, and 1.25

per cent. proteids. She had absolutely no symptoms and several careful examinations showed no signs of illness beyond a slight pallor. Her bowel movements were normal and there was no vomiting, regurgitation or even belching. She had neither gained nor lost in weight; but the fact that she had failed to gain in two weeks called attention to her loss of appetite. In this case very minute doses of tincture of nux vomica with sodium bicarbonate before feeding, together with a gradual increase in the proteids in her milk mixture up to 2 per cent., helped the child. In two weeks she showed a slight increase in weight, but only after two months, with the beginning of cooler weather, did she again take more at each feeding, and then rapidly regained her normal weight.

Having thus had my attention called to this condition, over a dozen cases have come under my observation since that time. All got well in time, but they only really recovered appetites after the heated term had passed.

In the treatment of these cases several plans were tried. In some infants all food was stopped, barley water started, followed by whey, with a gradual increase in the strength of the mixtures; in others the strength of the food was at once increased gradually, until the baby took a decidedly stronger mixture, up to almost double the strength of the one of which only a half quantity had been ingested.

But neither plan seemed to have any marked effect upon the patient until the advent of cooler weather. Therefore it is my method now to give the child two weeks to gain; if this fails, I suggest moving to a cooler climate at once.

My intention in writing this short paper was to call your attention to this probably functional disorder, infantile anorexia, which occurs during hot weather only, and seemingly can only be cured by a change of climate, to cooler surroundings. In spite of treatment, it seems to be the difference in atmospheric temperature which stimulates the infant's appetite, and as the result, intestinal digestion again becomes normal.

A Preliminary Report on a Study of Fractures of the Head of the Radius, With Special Reference to its Frequency and to Fractures of the Neck of the Radius.

BY T. TURNER THOMAS, M. D.

[Read June 14.]

The difficulties in diagnosis and the uncertainties in prognosis of this fracture were forcibly impressed upon me by the first case I saw, which occurred in July, 1903. The literature proved to be very interesting though scanty. The revelation of the skiagraph and a study of the anatomy of the part, suggested to my mind the possibility of adding something to our knowledge of this fracture. On February 9, of this year I saw my second case. The clinical picture was almost the exact counterpart of the first, which I had failed to diagnose until the skiagraph had revealed the fracture. What was an obscure fracture in the first case, now seemed very clear. The study of the first, with the revelation of the skiagraph, and the search of the literature, enabled me to make the diagnosis without much difficulty. In neither case could crepitus, mobility of the fragments or deformity be detected. In a very careful search of the literature, I have found no case in which the diagnosis of this fracture has been made during life, without crepitus. Typical fractures produced on the cadaver, have shown conclusively that crepitus, mobility of the fragments and deformity may be entirely absent. Moreover, I believe that this is the rule, not the exception.

The following is a brief summary of the two cases which I have to report: Both fell heavily forward, and each thought that she had struck her elbow. It is very likely that the weight of the body was received on the palm of the hand in each instance. In both another physician had examined the elbow immediately after the accident and had failed to make a diagnosis. In both cases I saw the patient first about twenty-four hours later, and in both failed to obtain crepitus, mobility of the fragments or deformity. In the first case I did not make the diagnosis, but suspected a fracture from the severity of the pain and tenderness and limitation of motion in the elbow, in the presence of what I thought too little swelling and edema for a contusion or sprain, which would give so much disturbance within the joint. In the second case, however, from my study of the first, I had little difficulty in making the diagnosis, which the skiagraph confirmed.

Examination of the second case: The elbow was swollen and edematous, but not excessively so, being most marked externally. Pain was marked, especially on motion of the elbow. A systematic search was made to locate the exact seat of injury. There was no shortening or other sign of fracture of the humerus, nor of the ulna or shaft of the radius. When, however, the head of the radius was touched by the finger the patient said at once "that is the place." The head distinctly moved with the shaft, and there was no crepitus, mobility of the fragments or deformity. The pain on movement, however, was excruciating, and the limitation of movement very marked, more particularly of pronation and supination. Voluntary rotation was impossible, on account of the pain induced by the effort.

Treatment: Both cases were immobilized at a right angle for about four weeks. Gentle passive motion at each change of the dressing was begun after the first ten days. Both patients were placed in the hands of a masseur for three or four weeks, with good results in each; although in the second there were suspicious signs of a refracture during manipulations of the masseur. Both have now almost perfect function.

In a study of fractures of the head of the radius, one is impressed at the outset with their remarkable obscurity and as a result of this their very scanty literature. No fracture of the body of equal importance has been so frequently overlooked. Gant[1] says: "Fracture of the head of the radius occurring alone, has, I believe, never been met with. In conjunction with fracture of the coronoid process, it has occurred in two instances both in the same subject."

Berard,[2] in 1834, reported the first case, which he discovered postmortem, and as late as 1893 Ashhurst[3] states that "Fracture of the head of the radius is a rare form of injury which does not appear to have been recognized during life, though the possibility of its occurrence has been demonstrated by dissection.

Bruns,[4] in 1880, collected twenty-one cases from the literature, in twenty of which the fracture had been proven by anatomical investigation. He said nothing of the case not so confirmed. He reported a case, also demonstrated by postmortem dissection.

Our text-books on general surgery give it only passing notice from which we may assume that it is still considered to be rare.

Since the advent of skiagraphy into the field of surgery, we have learned of many fractures of comparatively frequent occurrence that were previously overlooked. They are usually fractures of small bones

or bony prominences, particularly about joints, and in some instances they have been shown to be sprain or tear fractures. These are due to the separation of muscular or ligamentous attachments, from sprains or fractures with which sprains are associated. For instance, in a Pott's fracture of the fibula, the internal lateral ligament of the ankle remains intact and tears off the tip of the internal malleolus and the inferior tibiofibular ligament partially separates the adjacent surface of the tibia. Fractures of the head of the radius can not be placed in this class since no ligament is attached to it except a very thin reflection of the capsule.

The skiagraph, however, has not done away with the necessity for an accurate diagnosis based upon the clinical evidence. The great majority of physicians are still without the opportunities for the general use of the skiagraph. The cost of the necessary apparatus and the skill required in the interpretation of its shadows will compel the average doctor for many years if not always to depend on his sense of touch and his previous study and experience in similar cases. Moreover, in the hands of the best skiagraphers there are many cases in which the skiagraphic evidence of fracture is at least doubtful and the clinical signs more positive.

In a longitudinal fracture of the head of the radius, the approximation of the fragments is often so close that a skiagraph might fail to show it, especially if the plate is an obscure one or the exposure made in the wrong direction.

It has been said that by taking two pictures at right angles to each other, it is practically impossible for even the slightest fracture to escape detection; taking for granted of course that the technique is not at fault.[5] But the technique is often at fault, as any one may judge, who sees many skiagraphs of fractures.

In my second case two pictures were taken, an anteroposterior view and a lateral view. The anteroposterior showed no sign of fracture, the lateral showed it clearly. There was an appreciable separation, and slight depression of the detached fragment. This depression appeared to be frequent and was present in my first case also. A fall on the hand would readily account for it. In one or two of the experimental fractures the approximation was much closer, and the depression absent. How much influence hemorrhage from the fractured surfaces would have in separating the fragments is, of course, problematical. If the close approximation of the experimental fractures, and the absence of depression had occurred in this case, the detection of

the line of fracture would have been more difficult, especially if it had not been suspected previously. If the line of fracture had been wedge-shaped, as in a large proportion of the experimental fractures, the line of fracture on one side of the wedge would have been directly over that on the other side, the one confusing the other. The direction of the rays would not have been in the line of fracture, which would further have been confused by being taken through bone. I am convinced that many of them do escape detection, even by the skiagraph. In one case from the literature (Gordon), the skiagraph showed only the fracture of the neck, the fracture of the head being found only after excision of the head. It therefore becomes necessary to locate as nearly as possible the seat of fracture, and to so inform the skiagrapher, who will, from such information, be almost sure to find it.

Frequency.—We know that fractures of the lower end of the radius are among the most frequent that occur; but as we pass upward fractures of that bone become less common. As we approach the elbow they become more obscure, because the bone is there more difficult to examine, because more deeply situated, except in the depression on the surface just below the external condyle, posteriorly, where the head is superficial. The difficulties in diagnosis are further increased by the fact that it is in close contact with the ulna and the humerus, small fragments of which may be broken off. By far the most important factor in obscuring the diagnosis is the close approximation of the fragments by the orbicular ligament, which is probably intact in the great majority of cases. The difficulties in diagnosis account for the apparent infrequency. Although the skiagraph has failed to detect these fractures in some cases, it has demonstrated that they are so frequent that they demand more attention at the hands of the profession than they have yet received.

Ross and Wilbert[5] have published three series of 500 consequitive fractures of the extremities, as shown by the skiagraph. The writers say that the statistics are apt to be influenced by the class of industrial plants from which a large percentage of the accidents are derived. They will also be influenced by the fact that frequently doctors send for skiagraphic diagnosis only those fractures which are difficult of detection, so that the frequency of the obscure fractures in such statistics will be unduly high. For instance, I observe that the number of fractures of the clavicle is only eleven in the first series, thirteen in the second and eleven in the third, making a total of thirty-five in the 1,500 fractures, or about 2 per cent. Gurlt quotes the statistics

from the London Hospital, made up from the annual reports from 1842 to 1877, in which the percentage of fractures of the clavicle was 15 per cent. of all fractures, or about 20 per cent. of the fractures of the extremities.

It is worth noting, however, that in the fractures of clavicle, shaft of the humerus and patella, which I have selected for comparison, there is little variation in the three series, which would tend to confirm the general accuracy of the statistics.

There were nine fractures of the shaft of the humerus in the first series, ten in the second and nine in the third or twenty- eight in all.

Of the fractures of the patella, there were five in the first, five in the second and seven in the third or seventeen in all.

In the first series there were eight fractures of the head and neck of the radius, seven in the second and three in the third or eighteen in all.

For purposes of comparison we are apparently confronted with a difficulty, since the first series includes fractures of the neck of the radius with the fractures of the head. Bruns says "The fracture of the head is well differentiated from that occurring here and there, a transverse fracture of the neck, in which the head is entirely separated from the diaphysis, and is called a fracture of the neck of the radius."

If this were so, we still have the fact established that fractures of the head are much more frequent than is generally supposed. Comparison with the numbers of fractures of the shaft of the humerus and of the patella in the last 1,000 cases, shows that there were nineteen of the humerus, twelve of the patella and ten of the head of the radius.

While I was not successful in producing a fracture of the neck of the radius by the same force with which I did the fractures of the head, I believe that they are due to the same cause, a fall on the hand.

von Bergman says of these fractures of the neck: "In regard to the etiology and mechanism, accurate observation and investigation are lacking."

Stimson in his work on fractures, discusses them together and says that he knows of only one case (Mütter) of fracture of the neck without splitting of the head. In Dr. H. K. Pancoast's collection of skiagraphs at the University of Pennsylvania, I selected two fractures of the neck of the radius, in which the upper end of the radial shaft was impacted into the head in each case. The head was much de-

pressed in each, below its normal level, particularly on the outer side. This depression shows, I think, that the head had been driven downward by the impact of the capitellum, as in a fall on the hand. From the position of the forearm bones one can see that they are approximately in supination. The depressed portion of the head corresponds approximately to the position of the detached fragment in the usual fracture of the head. In pronation this depressed part would be anterior, and would then correspond to the point of impact of the capitellum in a fall on the hand. We can easily conceive of the whole head being tilted downward and forward, the neck giving way instead of the usual detached portion of the head, which is anterior at the time of the fall. There is firm union in this case in spite of the history of persistent movements of the part from the time of the accident and for a time at least at the hands of a masseur, which indicates that impaction must have existed. This impaction in itself points strongly to a fall on the hand as the cause of the fracture. I observe that the anteroposterior diameter of the neck is slightly less than the lateral diameter, when the forearm is in the prone position. The neck is, therefore, less resistant to the force applied to it in falls on the hand in the prone than in the supine position.

In the Mütter museum in this city, are two specimens of fracture of the neck of the radius. In one of them, probably the specimen referred to by Stimson, there is marked angular deformity at the seat of fracture, which is just above the bicipital tuberosity. The head is considerably deformed and, I believe, shows distinct evidence of previous fracture. The whole specimen consists of the bones of the upper extremity from the shoulder down. The forearm, I should say, is in extreme supination. The whole head is depressed as in Dr. Pancoast's two skiagraphs of fracture of the neck, and approximately the same part of the head is much more depressed than the rest and to about the same extent. This depression is most marked about posteroexternally, whereas in the skiagraph it is apparently external. This difference is probably due to the fact that one cannot determine in a skiagraph, absolutely, the position of the forearm by the position of the bones, and the fact that the depressed part will vary its position according to that of the forearm. In this specimen the most depressed portion would be anterior in pronation, and would correspond to the point of impact of the capitellum in a fall on the hand. I, therefore, argue that a fall on the hand was the most likely cause of

the fracture of the neck (and head?) in this specimen. In one of Dr. Pancoast's cases there was a distinct history of a heavy fall on that hand, the elbow being extended. In his other case, the history shows that the patient slipped on the ice in such a way as to fall backward and toward the injured side. He had on his overcoat, and his hands were in the pockets of the overcoat. He says that when he fell his two hands remained in his pockets, and that he struck on his elbow. In spite of this, I believe that he unconsciously withdrew his hands from the pockets in time to break the force of the fall with one or both of them. He might have used his hands to the same effect while they were in his pockets. What impresses a patient most about an injury is the pain, and in this fracture it was at the elbow, so that the attention of the patient was at once directed to that part as the place where the force must have been received. The proof of the cause is in the skiagraph. A fall on the elbow could not produce such a deformity, only a fall on the hand will explain it.

In the second specimen of fracture of the neck, from the Mütter museum, there is complete separation at the seat of fracture in the neck and there is no deformity present; the fragments probably being straightened in the setting of the specimen. There is, however, a Colles' fracture in the same bone, which would seem to establish that the cause of both fractures in this specimen was a fall on the hand.

To return to the skiagraphic statistics and their importance in establishing the frequency of this fracture, I consider that fracture of the head and neck are essentially the same, both being very frequently associated, both giving rise to very much the same symptoms, prognosis and treatment, and especially since both involve practically the same part of the radius, and are due to the same cause. According to these statistics fractures of the head and neck are more frequent than fractures of the patella.

I have observed that the usual plate showing a posterior dislocation is a lateral view. If this were the rule, I am satisfied that a fracture of the head may easily be lost in many dislocations. We have only to look at the usual text-book illustration of that injury. The radial head is usually almost, and sometimes totally, obscured by the ulna and condyles of the humerus. If the forearm were in supination the detached fragment would be posteroexternal and almost surely lost in a lateral view, because the line of fracture would not then be in the line of the rays, but almost at right angles to them. It should be borne

in mind that one of the first important facts shown in the history of the fracture, is that it was frequently associated with posterior dislocations of both bones at the elbow. I believe that many of them are still being lost in this way.

Resumé of Experimental Work.—The method of producing the fractures was as follows: The upper extremity was disarticulated at the shoulder, the palm of the hand was placed on the ground, the extended arm with forearm pronated was held vertically, and the blows of an ordinary mallet were applied to the top of the head of the humerus. The blows of the mallet represent the action of the force resulting from a fall on the hand, more nearly than would the blows of the mallet applied to the palm of the hand in the opposite direction.

With the limb in the position described, the capitellum is in contact with only the anterior part of the head of the radius, which is the portion of the head broken off in the typical fracture. It is interesting to observe that while the blows were applied to the top of the humerus without regard to their influence at the elbow it was the radius that gave way every time, and only the radius.

Six fractures were produced with comparative ease, and each one corresponds to the fracture most frequently reported as occurring during life. The only failure that occurred was produced by a much heavier instrument than the wooden mallet, and in that case the production of a Colles' fracture prevented the continuance of the force.

Every fracture had the following points in common. About the anterior one-third or one-half of the radial head was broken off. In every case the position of the detached fragment varied only with the degree of pronation and supination. With the forearm in full supination the fragment occupied a posteroexternal position, in full pronation an anterointernal one; the line of fracture internally passing through the lesser sigmoid cavity of the ulna. In the usual fall on the hand the forearm is not quite in full pronation, so that the point of impact of the capitellum of the humerus is more anterior. The fragment was attached to the reflected capsule and periosteum of the radius in every case. In some the line of fracture was almost straight, in others somewhat wedge-shaped.

The lines of fracture usually radiated from the periphery toward the centre of the head giving the detached fragment, generally including about a third of the head, a more or less wedge-shape. The intact orbicular ligament held the fragments so closely together that deformity and crepitus could not be produced by any of the ordinary

manipulations. Even with the detached fragment in the grasp of the fingers, after removal of the orbicular ligament, lateral movement could not be produced, because of the wedge-shape of the small fragment.

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DISCUSSION.

DR. GEORGE E. PFAHLER: In my discussion of fractures at the last meeting of the State Medical Society I called attention to this fracture and stated that it was more frequent than heretofore suspected. Since examining the first case to which Dr. Thomas refers, I have had at least 10 cases of the same kind. I do not believe that it is proper to estimate the frequency of fractures from the number of cases examined by the radiologist. These 10 occurred in probably 1,000 fractures. In contradistinction to what Dr. Thomas says I do not believe that an error need often be made in finding these fractures by radiodiagnosis. The symptoms to which Dr. Thomas refers are those that occur in the majority of the cases. In one of the cases brought to my attention the patient was thrown from a carriage upon her hand. This patient has recovered completely and so bears out the other evidence mentioned by Dr. Thomas.

DR. M. K. KASSABIAN: During the past 9 years I have had 8 cases of fracture of the head of the radius which were diagnosed by X-rays. Three of these were complicated with fracture of the coronoid process of the ulna and 1 with epiphyseal separation of the lower extremity of the humerus, 3 were oblique fractures of the head, 4 were transverse fractures of the neck, and one epiphyseal separation with the fracture of head. I agree with Dr. Thomas that skiagraphic examination of the elbow joint is difficult on account of the superimposition of many shadows, etc.; anteroposterior views are preferable; however, several views may often be necessary by changing the position of the tube, and often I make stereoscopic skiagraphs which are very useful in order to view the joint and fracture in relief. I am well convinced that there is no fracture that may escape our detection in examining with the X-rays, because our X-ray negatives show the texture and structure of the bone, therefore any disturbance in the texture will be shown on the negative by a careful examination.

DR. JOHN B. ROBERTS: It seems to me that this is a very interesting contribution to the subject. These experimental fractures are of great interest, and I should like to ask Dr. Thomas to present the specimens to the Mütter Museum. Two specimens already in the museum and called "cases of inflamed bone" are evidently fractures of this sort and never suspected by the cataloguers of the museum. The contribution is an illustration of how we advance in our surgical work; with the newer developments in science, like skiagraphy, we find that many of our old ideas are wrong.

DR. L. J. HAMMOND: It has occurred to me that experimental fractures would take place under conditions which we would not have in living patients. In reference to treatment, from my large experience in the outpatient department of the Methodist Hospital I have come to regard fractures about the joints as not so serious as I was taught to believe. Therefore, I do no hesitate to leave a fracture of the elbow joint immobilized for 3 or 4 weeks, then remove the dressing every day or every other day. With this method and with the employment of passive motion I have yet to see a case of simple fracture in which there has been loss of joint motion. While these skiagraphs are readily interpreted by the gentlemen familiar with them, I cannot see how the surgeon, inexperienced in X-ray work, can use them for working principles.

DR. THOMAS: It seems to me that there is plenty of room for error by the skiagrapher in interpreting injuries in this region. The fragments are often so closely approximated that if the exposure is not in the line of fracture and the plate a good one the X-ray diagnosis must be doubtful. Dr. Kassabian speaks of a fracture in which an oblique portion of the head is broken off by an almost vertical line of fracture, and of a transverse fracture of the neck. These are the 2 usual fractures. Dr. Kassabian thinks that I was a little severe on the deficiencies of the skiagraph. I wish only to emphasize the possibility of error. I wish to call attention again to the fact that of one of these fractures, 2 skiagraphs were taken. They are both good pictures taken by a good skiagrapher, and yet one view shows no sign of fracture, the other does show it very clearly. It is difficult to do experimental work, with reference to epiphyseal separations, because the bodies are most difficult to secure. In answer to Dr. Roberts' suggestion, I would be only too glad to place the specimens in the Mütter Museum. They are easily produced, and I had intended to throw them away. In regard to Dr. Hammond's objection as to the value of the experimental work, we must remember that the fracture occurs at the same point every time, that it occurs where the joint is weak, the head breaking off where the force is received by it in falls on the hand, that the force comes down through the humerus, and that the same part breaks off in experimental work as in life. The skiagraph shows that the detached fragment is anterior in pronation and corresponds to the portion of the radial head receiving the impact of the capitellum of the humerus in falls on the hand. In supination the fragment is external.

Rest and Exercise in Tuberculosis.

WILLIAM B. STANTON, M.D.

[Read September 13.]

The modern treatment of tuberculosis may well be considered under three headings: (1) Abundant and nutritious food; (2) a maximum amount of fresh air; (3) careful regulation of exercise. The

majority of practitioners have accepted the first two propositions, but about the third there seems to be widespread misunderstanding. Many believe that fresh air can only be obtained by physical exertion out of doors, while others seem to think that open air exercise acts specifically on the disease. Among the laity these ideas are practically universal.

While the value of exercise in properly selected cases is very great the harm done by injudicious exercise in acute cases is infinitely greater. The problem in each case is how can we best obtain a state of normal or even supernormal nutrition; for it is now believed that increasing the nutrition of the body increases the resistance to the tubercle bacillus and thus produces cure. The state of the nutrition of the body represents the difference between the amount of food assimilated and the amount dissipated by muscular action, disease or other cause. In other words, the body nutrition may be looked upon as a bank account; the deposits are the amounts of food assimilated; the drafts are the amounts of nutrition used up in carrying on the essential functions of the organism, the nutrition destroyed in voluntary muscular action, and, in tuberculosis or other wasting maladies, the nutrition necessary to repair or replace the tissue destroyed by the disease process. The deposits may be increased by giving large amounts of properly selected foods together with abundant fresh air. The drafts can only be lessened in one way in tuberculosis. The essential functions must be carried on in order to maintain life; the progress of the disease cannot be checked by any medicament now known; but by proper regulation of the voluntary exercise a very large amount of nutrition may be saved to increase the general store of the body. This increased nutrition and resistance is shown by increased weight and by diminution in the fever, pulse rate, etc.

The amount of exercise to be allowed to a patient depends upon several conditions: (1) Temperature, (2) pulse rate, (3) respiratory rate, (4) degree of emaciation, (5) existence of complications in heart, kidneys, intestines, pleura, bladder, etc.

Constant temperature above 100° indicates acuteness and progression and calls for absolute rest in bed. When in the course of a practically afebrile case a cold or other condition causes a rise to this extent, rest in bed is also necessary. Ordinary remittent temperature, normal or subnormal in the morning and elevated in the afternoon, requires rest in bed if the afternoon elevation is over 101°. If the afternoon rise is only 100° the patient may be allowed out of bed the

greater part of the time but must not take any formal exercise. When the evening temperature is under 100° exercise may be begun, if other conditions are favorable, and gradually increased. Rarely in tuberculosis there is a reversal of temperature, the elevation occurring in the morning, and it may not be detected by the ordinary method of taking the temperature. In such cases the other evidences of progressive disease will point to the necessity for rest. It may be well to emphasize the importance of taking the temperature twice daily in all cases, at least for a short time.

The pulse rate is of great value as a guide to the regulation of the exercise. Very often in tuberculosis the pulse is at variance with the temperature. Usually it is proportionately higher. There is also a tendency to rapidity upon comparatively slight exertion especially when the patient is under weight. Along with this tendency to elevation of the pulse rate there will be found in a large number of cases a soft, blowing systolic murmur with maximum intensity over the base of the heart and not transmitted to the axilla. This murmur, which has many of the characteristics of the socalled hemic murmur, is not necessarily associated with any special impoverishment of the blood. The murmur disappears when the patient is erect and many times gives rise to a diagnosis of mitral regurgitation in patients who are examined only in the recumbent position. In the vast majority of such cases no true lesion of the valves is present. The condition is probably due to a weakness of the papillary muscles and is simply the expression of a cardiac weakness which is part of the general loss of muscular power. Dogmatically it may be said that a morning pulse rate of 120 or over indicates absolute rest in bed, if it is 110 or under the patient may be allowed up a part of the day if other conditions are satisfactory. When the pulse is under 100 exercise may be begun and gradually increased. Persistently rapid pulse may be found in cases in which the involvement is rather widespread but in which the temperature is low. It is probably one of the manifestations of toxic absorption.

The respiratory rate is usually dependent upon the degree of involvement of the lungs and the competency of the heart. Miliary tuberculosis with few signs in the lungs and with low temperature often shows itself by slight cyanosis and hurried breathing. In old quiescent cases with much destruction of tissue, dyspnea on exertion is common. As a rule, it may be said that when the breathing rate is over 30 per minute, at rest, exercise should not be attempted.

The degree of emaciation present in the patient is a most important factor in the determination of the amount of exercise to be allowed. The effect of tuberculosis in producing tissue waste has already been pointed out. When the individual is greatly reduced, even though the temperature and other signs are satisfactory, exercise should not be allowed. The patient may be allowed out of bed for the larger part of the time but must sit or recline out of doors until the weight shows a sufficient increase. Such patients should spend at least two hours daily lying down and all tuberculous patients should have at least nine hours sleep.

The presence of complications in tuberculosis naturally affects the course of the disease and also influences the regulation of exercise. In general it may be said that the complicating disease should decide the amount of exercise to be allowed; remembering that with two depressing influences present the need for rest is apt to be greater.

Concerning the best form of exercise in tuberculosis much has been written. Many of the methods advocated have much to recommend them. The difficulty lies in the fact that they can only be employed by trained nurses or instructors which makes any complicated series of movements out of the power of the average practitioner. Fortunately the most common form of exercise, walking, is one of the best in tuberculosis and is one of the easiest to regulate. Beginning with ten or twenty minutes daily, this may be increased five minutes each day until the patient is walking hours at a time. At first the walk must be only upon level ground and very stringent orders must be given to walk slowly. The daily record of the pulse and temperature must be carefully watched and any elevation of either indicates a diminution or omission of exercise. After the patient can take a full two hours' walk on the level without disturbance in the pulse and temperature, gentle elevations may be attempted. Here too the same care as to slowness must be insisted upon. The great disadvantage of most forms of exercise that can be prescribed is that they grow monotonous. In institutions the best results can be obtained by allotting certain duties to each patient, the length of time employed and the hardness of the work being proportioned to the individual ability. The fact of doing some purposeful work together with the knowledge that they are returning to their normal strength is of great help in maintaining the cheerfulness of mind which is so important in the treatment of a chronic condition.

Exhibition of Case of Gastrostomy.

BY STILLWELL C. BURNS, M. D.

[May 10.]

The patient upon whom gastrostomy was done for carcinoma of the cardiac end of the stomach, was exhibited for Dr. Rodman. At the time of the operation the man could only swallow liquids in teaspoonful doses. The operation done was that known as the Kocher modification of the Ssabanijeu-Franck operation. Dr. Burns outlined the technique of the operation and said that the case was presented because the operation had fulfilled all the indications for which it was performed and had stood the crucial test in that it had never leaked a drop. The man has gained much in strength.

Exhibition of Centrifuge.

BY H. E. WETHERILL, M. D.

[May 10.]

Dr. Wetherill exhibited a 20 cc. centrifuge constructed upon the same plan as the hematokrit previously exhibited by him. The speed does not have to be faster than 5,000 revolutions per minute. It is operated by hand-pull, and is made to work on a door-knob.

The special advantage is that when the straight tubes are stopped in the horizontal position the fluids and precipitates are not mixed, even though the tubes are not full.

The tubes are reversible so that the particular fluid can be put in the end desired.

As the ledged corks prevent evaporation of infectious fluids, and the detachable, screwed-in tubes act as stands for the decimally-calibrated, strongly-made tubes, the instrument is handy, portable and economical for the clinician.

The bottles are calibrated for immediate precipitations of albumin as in the Esbach's albumin test.

The scales are arranged for making equivalent weight values of volumetric precipitations.

The corks when inserted give a bubble-free tube of definite content (20 cc.).

This instrument of precision is shown because it is accurate, practical and does what other centrifuges do, but is more durable and safer than others, and does things which they do not.

They may be made with numerous arms.

Special tables for the conversion of the cc. values into percentages are made, and temperature correction values of water volumes are being calculated.

The instrument works easily, and its safety was demonstrated by operation at a high speed in the hands. Gearing is substituted by cords, the motion being to and fro; and time, leverage, regularity and pressure factors are not important.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

SYMPOSIUM ON DIABETES.

[October 11.]

The Physiology of Glycolysis.*

By David L. Edsall, M. D.

The first of the main facts known about the fate of carbohydrates in the body, after they leave the digestive tract, is that some, or perhaps all, the sugar thus absorbed passes through the glycogen stage, this glycogen being stored in the liver especially, and in the muscles, bound fast to the extent that it can not readily escape but can easily be called for when needed. It is not known whether or not some sugar is passed on into the circulation at once without going through the glycogen stage, but it is known that the amount in the circulation is kept within narrow bounds, and as a portion is used more is derived from the glycogen stores; the glycogen being transformed into dextrose, apparently by diastatic ferments. If the amount in the circulation rises much above the normal, a condition termed hyperglycemia, the excess produces glycosuria. This occurs in diabetes and also as a result of the ingestion of very large amounts of sugar at one time, as a consequence of the action of some exogenous and endogenous poisons, and, temporarily, (and perhaps persistently) when there are certain nervous lesions.

After the sugar reaches the circulation it is broken down in a manner that is as yet obscure, except in the fact that complete exclusion of the function of the pancreas, through removal of this organ, interferes with the process so largely as always to produce a fatal diabetes, though apparently small amounts of sugar still undergo disintegration. It is thought by many investigators that the sugar

* Abstract of the remarks made by Dr. Edsall.

passes through the stage of glycuronic acid, and possibly lactic acid, oxalic acid and other known substances form stages, but these points are still unsettled. Ultimately it reaches chiefly the stages of carbon dioxid and water and is excreted as such.

One point of great practical importance in connection with the intoxication that occurs in diabetes, and at times in other diseases and even in normal persons, is that in the course of the utilization of sugars, some process occurs that prevents the flooding of the organism with acids that develop from the other foods, especially the fats; and if this process is interfered with by the complete or almost complete exclusion of carbohydrates from the diet, in diabetics or in others, the patient develops acid intoxication and may die of it. This is usually controlled, temporarily at least, by the use of large amounts of alkalies and by reintroducing carbohydrates into the diet.

The way in which the sugar is broken down normally, and the difficulty in diabetes, remain undetermined. It has been suggested that a glycolytic ferment exists in the blood; but this has not been proved, and if such a blood ferment is present its action is apparently insignificant. It has also been claimed that the pancreas provides a glycolytic ferment, but this is also unproved, and, indeed, largely disproved. More recently it seemed to have been demonstrated that liver and pancreas, or muscle and pancreas, acting together, cause rapid glycolysis, but there is now much reason for thinking that these claims were based upon results due to bacterial action or to simpler chemical conditions that were unappreciated by the experimenters and that perhaps do not occur in the course of actual metabolism. The recent claim that all tissues provide an active glycolytic ferment is apparently disproved, though all tissues do seem to exert a slight oxidizing action upon sugars as well as upon many other substances. Glycolytic ferment action probably does occur but has not been demonstrated. In addition to the possibility of a disturbance of ferment action it has been suggested that the pancreas destroys, or annuls the action of, some substances that regularly reaches the circulation; and that in diabetes this does not occur; also that the action of the pancreas is to prevent too rapid a diastatic conversion of glycogen into dextrose. Further, it may be that the difficulty in diabetes is in glycogen formation or in the binding fast of the glycogen in the organs; in either of these cases sugar would enter the circulation in excessive amounts. Or it is quite possible that most or all the sugar that normally enters the circulation

does so in some combination and that if any considerable amount enters the circulation in free solution it is at once excreted; in diabetes, it is thought possible that the combining substances may not be present in sufficient amount and hence more or less sugar circulates in free solution, and this produces glycosuria and the other symptoms.

It is quite possible that all the theories, or several, at least, may represent an important portion of the whole truth. Certainly the condition generally termed diabetes is not always the same disease, and the differences in different cases may be due to the presence in one instance of one of the above mentioned hypothetical disturbances, and in another instance to the presence of another disturbance. At any rate, it is clear that the metabolism of sugars is not the simple process of direct oxidation that it was long said to be, but is a much more complex matter in which various synthetic as well as destructive processes probably occur.

Varieties of Glycosuria.

BY L. NAPOLEON BOSTON, M. D.

In discussing the varieties of glycosuria one has to deal with conditions wherein glucose appears in the urine in pathologic amount; yet it is possible to find a mere trace of glucose in normal urine, but such traces are not capable of detection by the reagents commonly employed for this purpose, and whenever a positive reaction for glucose is obtained by one or more of our present laboratory methods, pathologic glycosuria exists. It appears that glycosuria may, for sake of convenience, be classified according to its apparent etiologic factors; yet it is true that the casual factor in many instances is unknown.

(1) *Glycosuria of pancreatic origin* occurs when there is permanent damaging of the pancreas, such a lesion may be malignant or non-malignant, but must interfere with the islands of Langerhans.

It appears unnecessary to discuss at length the various lesions of the pancreas that are capable of causing glycosuria. It is generally conceded that the function of the entire gland need not be impaired in order that the urine contain glucose. Hausemann, of Berlin, claims that pancreatic disease with diabetes is more common than is either diabetes or disease of the pancreas alone.

(2) *Hemic glycosuria* is believed, by a certain number of observers,

to exist, and Crofton attributes to the blood ferment in the leukocytes, at least, a partial causative influence in its production; yet I am not aware that there are many supporters of the belief that true hemic glycosuria exists. Glycosuria develops during the course of such chronic maladies as leukemia, Addison's disease, tuberculosis, and other conditions in which severe secondary anemia forms a prominent symptom.

(3) *Glycosuria of suprarenal origin.*—The suprarenal gland may be found diseased in certain cases in which diabetes was known to have existed during life, but the number of cases of diabetes dependent upon suprarenal disease is certainly few.

(4) *Glycosuria of hepatic origin.*—It is well-known that should the general function of the liver be interfered with, glycosuria results. Malignant disease of the liver is by no means necessary; and glycosuria may obtain where there is either nervous, circulatory or other hepatic derangement. In this connection we have glycosuria following irritation of the pneumogastric nerve or any portion of the sympathetic system. Gall stones or obstruction to the flow of bile cause the liver to unload its glycogen, and likewise glycosuria may follow either active or passive hepatic congestion. Interference with the circulation of the return portal blood may also be followed by glycosuria.

(5) *Alimentary Glycosuria.*—This is probably the commonest form of glycosuria, and the form which we are all called upon to treat. It is this form of glycosuria that is not always associated with polyuria, and I have records of twelve cases of glycosuria in which the percentage of sugar was rather large, and yet the quantity of urine voided in the twenty-four hours did not exceed fifty ounces.

Strictly speaking, none of these cases could be regarded as true diabetes, yet, so far as I was able to learn through our present laboratory methods, they were secreting sugar in pathologic amounts. These cases were all misleading, presenting obscure symptoms, none of which would ordinarily be attributed to the presence of sugar in the blood, yet in every instance these symptoms disappeared when the glycosuria had abated. None of these patients complained of loss of weight, but all expressed a sense of languor, muscular soreness, pain and mental dulness. It is possible to have a large amount of sugar excreted daily in proportion to the quantity of urine passed, but when the quantity of urine and percentage of sugar are studied collectively, the body depletion is seen to be comparatively slight. I have noticed that four

of these patients developed glycosuria periodically; in some of them the attacks would appear every two months; in others every three to six months; and in one, who has been under my charge for three years and has just passed through his third attack, each attack occurred during the month of September. Since under my care this patient has never been known to void over fifty ounces of urine daily, and this urine has never contained more than 1.25 per cent. of sugar. Alimentary glycosuria is dependent upon gastrointestinal derangements and upon the too free imbibition of carbohydrates and sugar producing foods.

(6) *Glycosuria, apparently of nervous origin,* may be encountered, and it is difficult to show that the socalled toxic glycosuria is not nervous in character. The urine may contain glucose after traumatism to the head, chest, abdomen, or after the fracture of certain of the long bones, cerebral abscess or tumor, sclerosis of the cord and neuralgias. It is not perfectly established whether or not in trauma the glycosuria results from shock, or from direct injury to certain centers. Lesion of the fourth ventricle is also capable of causing the urine to give a reaction for glucose.

Transitory glycosuria may be considered under the following subheadings: (7) Toxic, those associated with disease or injury of the human organism, and (8) puerperal glycosuria.

(7) *Toxic Glycosuria.*—Toxic glycosuria is to be seen after the administration of certain drugs, among which should be mentioned hydrochloric and sulphuric acids, mercury, strychnin, glycerin, lead, arsenic, phosphorus, potassium iodid, alcohol, nitrobenzol, caffein, thyroid extract, tuberculin, pancreatin, diuretin, phloridzin, carbon monoxid, and morphin. Glycosuria may also follow the administration of analgesics and anesthetics, and there are valid records of cases in which it has followed the use of chloral, chloroform and ether anesthesia. Indeed, Andral cites an instance in which diabetes followed ether anesthesia.

Glycosuria occurring during the course of infectious fevers is probably of toxic origin, and commonly occurs during the course of cerebrospinal meningitis and less often in phthisis, tonsillitis, typhoid fever, relapsing fever, cholera, and certain of the exanthemata. It has been observed during the course of tuberculosis of the bones, malarial paroxysms, chronic nephritis, whooping cough, syphilis and asthma. Transitory glycosuria of the aged was first described by the late J. M. Da Costa.

Severe mental strain is not infrequently followed by transitory glycosuria, which in many instances becomes a permanent diabetes. I have in mind three instances that will illustrate this variety of diabetes. Two of the patients lost heavily in the Lake Superior catastrophe last year, and since that time have developed diabetes. The third case, a woman, aged forty years, developed glycosuria almost immediately after the death of her husband, and is now voiding 1.25 per cent. of sugar. Glycosuria developing from overwork or extreme mental strain is likely to be permanent.

Exhaustion is not infrequently followed by glycosuria. It is the rule to find that the evening urine contains a higher percentage of glucose than the morning specimen.

The term functional glycosuria may well be applied to many of the conditions just described, yet I do not see that it has any special advantage. The intermittent glycosuria of arthritis should probably be included with hereditary glycosuria of children and with the intermittent glycosuria of obesity and of gouty adults.

Glycosuria of children is doubtless inherited in nearly every instance, and while this condition is generally conceded to be rare, it has been rather common in my experience. During the past two years there have been handed to me at the Medico-Chirurgical College Laboratory eight specimens of glycosuric urine collected from children, all of whom were under two years of age. I have records of twenty-one cases in which glycosuria has occurred in children under six years of age. It may be interesting to note that in all these children the percentage of sugar excreted through the urine was very large. In none of the cases was it possible to ascertain the quantity of urine voided in the twenty-four hours, and in fact it was often with great difficulty that sufficient urine was collected for a chemic analysis.

(8) *Puerperal Glycosuria.*—It is not extremely uncommon to find the urine giving a reaction for glucose during the puerperium; this reaction is oftenest seen two to ten days after delivery. In many instances the case is one of lactosuria. I now have under my care a patient who developed glycosuria at the eighth month of gestation; but now, four months after delivery, her urine is normal. Another instance was that of a primipara aged twenty-five years, who developed glycosuria (which persisted for fourteen days) after a rather difficult labor, forceps delivery and chloroform anesthesia. At present, a month after delivery, her urine is normal.

The Relations Between Diabetes Insipidus and Diabetes Mellitus.

By Aller G. Ellis, M. D.

The title of this paper is possibly to a certain degree misleading, as it tends at once to predicate a connection between the two named conditions. That they are genetically related is not clear, although well-known symptoms are common to both and in some cases of each the pathology, so far as it has been determined, is very similar. The purpose of this brief paper is to compare the two with the object of determining if an interrelation actually exists; it should be noted that in so doing one assumes the somewhat anomalous position of comparing a disease with what is often but little more than a symptom. The resemblances and differences of the two conditions may be considered under two headings, the clinical or symptomatic, and the pathologic, although under the former the etiology is closely allied to the pathology.

Clinically, we find that diabetes insipidus, in general, is a disease of younger persons than are subject to diabetes mellitus and is not so fatal. Saccharine diabetes is much more common, the insipid form being classed among the rare diseases. Futcher[1] says that in fifteen years there were only seven cases of diabetes insipidus among 403,535 patients treated in the Johns Hopkins Hospital and dispensary; while Osler[2] says that during this time there were 226 cases of diabetes mellitus among 99,000 patients in the medical ward and dispensary, 147 of them occurring in 18,000 ward cases. Tyson[3] states that in Philadelphia from 1870 to 1900 one death in every 402 was due to diabetes mellitus; he also records a general increase in the disease throughout the world, a point not true of diabetes insipidus. Emaciation is pronounced in some cases of symptomatic diabetes insipidus, but usually the weight and general condition of these patients are much better than in those suffering from the saccharine form. Complications, such as eczema, furunculosis, pneumonia and pulmonary tuberculosis, which are not infrequent during the course of diabetes mellitus, are essentially unknown in diabetes insipidus. The illy-understood coma which so often terminates the scene in diabetes mellitus is not commonly described as occurring in diabetes insipidus, although reference will later be made to what is possibly an instance. Polyuria and the resulting thirst are common to diabetes mellitus and diabetes insipidus, but both are usually more marked in the latter.

The urine in diabetes mellitus is commonly of high specific gravity,

most of the solids are increased, albumin is not infrequently present and aceton, diacetic and oxybutyric acids are found at times. The presence of glucose, often in large quantities, is the distinctive feature. In diabetes insipidus, also, the solids, with the possible exception of uric acid, are increased, but the enormous hydruria makes the urine of low specific gravity. It does not contain sugar, and albumin is rarely present.

Under the head of causes, many cases of both types have been ascribed to heredity, numerous familial series running through several generations. Owing to the obscurity regarding the pathology of each, a discussion of the other causes common to both forms is necessarily unsatisfactory, but the following have been considered etiologic factors in both: (1) Injuries to the nervous system, either central or peripheral, and disease of the former as meningitis, epilepsy and tumors of the brain. (2) Intense mental emotions as fright, anger, excitement and anxiety. In other words, the causes of the so-called "nervous" type of diabetes mellitus are practically identical with the causes of diabetes insipidus. The cases of diabetes mellitus due to lesions of the pancreas, which, according to most writers, form fully one-half the entire number, cannot be regarded as in any way etiologically related to diabetes insipidus. Tyson, however, says the channels in diabetes insipidus are probably the same as those through which saccharine diabetes results, but to the latter glucose is added, in the former it is absent. In Futcher's series of diabetes insipidus, syphilis played an important role, no less than four of the nine cases being ascribed to it. He regards syphilis as being a more common cause than is usually supposed; corresponding to this view is Tyson's statement that potassium iodid is the most satisfactory drug in the treatment of the condition. Syphilis does not appear to be a cause of diabetes mellitus.

The pathology of the two affections, touched upon while considering the etiology, is yet so obscure that a comparison of the lesions, which should form the principal basis for determining the relations between the diseases, is difficult and unsatisfactory. Although germane to the subject, it would lead too far afield to discuss the various theories advanced to account for each affection, hence I shall be content with giving what appears to be the most widely accepted general views regarding each.

Diabetes mellitus is essentially a disorder of metabolism, affecting the glycogenic or glycolytic function of the body and through it the sugar-regulating mechanism. Whether this function resides wholly

in the liver cells and is affected chiefly by the blood supply of that organ, hence depending largely or entirely upon the vasomotor nerve supply of the liver; or whether the work is accomplished in the muscles under the action of a ferment there produced and activated by an internal secretion of the pancreas, which, in turn, is regulated by a product of the adrenal; or whether the change is brought about in still other ways, is in a sense immaterial to this discussion. These points have been considered in their proper relations by the preceding speakers, and it is sufficient in this connection to know that through this overproduction or underdestruction of sugar, it appears in excessive quantities in the blood and urine and is the distinctive feature of diabetes mellitus. In this perverted function it differs from diabetes insipidus and on this point the two appear to bear to each other absolutely no relation.

Opposed to this, most writers agree that diabetes insipidus is primarily a nerve lesion, a disorder of innervation, which expends its force upon the kidney as an altered filtration or secreting power resulting in excessive flow of urine. The kidney, for whatever reason, appears to lose its power of delivering a urine of normal concentration, hence more fluid is necessary to eliminate the required solids. In diabetes mellitus, there is the sugar, in addition to an increased amount of other solids, to be excreted. The polyuria of the two conditions may, therefore, be regarded as possessing much in common, although in the one it follows changes closely associated with the kidney itself, while in the other various tissues and the blood are implicated. But even the pathology of polyuria is uncertain, as in addition to diabetes mellitus and insipidus, it accompanies chronic interstitial nephritis and some cases of hysteria. Lazarus-Barlow[4] says diabetes mellitus has peculiar characters, but it is probable that the excessive flow of urine is essentially of the same kind as the excessive flow in phosphaturia or azoturia and perhaps also in hydruria. He states it is generally held that in diabetes insipidus the increased flow of urine is due to local diminution of pressure in the renal artery caused by vasomotor disturbance, but it is difficult to understand how the renal vessels alone could be involved. A study of this explanation raises the question as to whether cerebral conditions have anything to do with hydruria. Lazarus-Barlow is attracted by the possibility (though it is only a surmise) that there is normally an exchange of fluids between the kidney tubules and the renal vessels. If this be true, then hydruria may well be the result of diminished absorption of water from the tubules or of increased addition to their fluid content. Considering

the amount of fibrous tissue surrounding the renal tubules in cases of chronic interstitial nephritis, diminished absorption could well be imagined, but in pancreatic diabetes this supposition does not appear so pertinent. The kidneys from cases of simple polyuria show practically no lesion, hence the difficulty of tracing the basis of the condition.

The feature which at first sight more than any other suggests a relation between the two conditions under discussion is that each has been known to change into the other. Futcher says a number of cases of diabetes insipidus have passed over into diabetes mellitus and *vice versa*, but gives no reference to them. Brayton[5] states there is a striking analogy between diabetes mellitus and insipidus in etiology and symptomatology and one sometimes merges into the other. Saundby[6] says azoturia may pass into diabetes mellitus, also that of eighteen cases of phosphaturia, six patients died of phthisis, three of diabetes mellitus and one of diabetes insipidus. Pribram[7] states that of ten cases of diabetes insipidus reported by him, one followed diabetes mellitus. Baumgarten,[8] in discussing Futcher's paper, mentioned a case of diabetes insipidus occurring in a young man; a year or two after its onset the disease took on the attributes of diabetes mellitus. There was neither evidence nor suspicion of cerebral disease or syphilis. The patient finally died of tuberculosis. Mann[9] states that the transition of diabetes insipidus into diabetes mellitus is a rare occurrence, only one case being reported by Senator in 1897. He describes an additional case under observation during its entire course. The patient was a man of forty-five, in whom the diagnosis was cholelithiasis and possibly carcinoma of the stomach. While under expectant treatment for a month, diabetes insipidus developed and was followed by diabetes mellitus, the latter being accompanied by intense acidosis. After lasting sixteen days the diabetes mellitus disappeared as suddenly as it came on, the acidosis vanishing before the sugar in the urine. At the end of two months the man was free from symptoms of either type. Mann says such an acute course was before unknown, transient cases lasting at least six weeks and then due to trauma or infectious diseases. The patient finally died of hematemesis and autopsy revealed a gangrenous carcinoma of the stomach. The pancreas was uninvolved macroscopically; the liver and brain were apparently normal.

Such cases appear to indicate some connection between the conditions, but the transition could occur without any underlying common ground. Edsall[10] says there appears to be no relation between

the two, at least so far as regards carbohydrate metabolism. And even if the view that protein metabolism is also at fault be correct, there appears no reason for believing that it, any more than the carbohydrate disturbance, is common to the two. A case reported by Carter[11], however, seems to indicate that a similarity in products is possible. Acute diabetes insipidus began in a girl of eight on June 27th, after excitement incident to a picnic. She died July 13th in coma which was two days developing. Carter says her condition was closely allied to, if not identical with, Kussmaul's coma in diabetes mellitus.

Clinically, then, in certain symptoms and occasionally in the course of the disease, diabetes mellitus and diabetes insipidus resemble each other. Pathologically, and this would be the true criterion were the pathology definitely known, they are related only in that certain lesions of the nervous system, principally those involving the medulla and floor of the fourth ventricle, may be present, probably as the cause, in either. Mental emotion or excitement may also be followed by either. But beyond these seeming relations there is the great difference that in diabetes mellitus there is superadded the vicious carbohydrate or protein metabolism that results in hyperglycemia and glycosuria. Butler[12] well states the condition by saying that most cases of diabetes mellitus are at first expressions of nutritional and assimilative instability. Overstrain of the various organs leads to permanent lesions and excessive sugar manufacture without proper disposal of the product. In diabetes insipidus this feature is lacking, and hence, as regards the fundamental character of the saccharine form, the two conditions are entirely unrelated. The mechanism of fluid or of solid excretion by the kidney is deranged in both, in some instances by the same underlying cause, but between the cause and its effect in the kidney there is in diabetes mellitus the serious but little understood phenomena culminating in the excessive output of sugar. Cases of each possessing a similar fundamental nature may change to the other, according as these phenomena are added to or taken away from the conditions common to both.

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The Management of Cases of Diabetes Mellitus.

By JAMES TYSON, M.D.

There has not been much added to our knowledge of the treatment of diabetes mellitus of late years, and yet its results may be considered, on the whole, more satisfactory in the last decade than prior to this period. This may be partly ascribed to a more accurate and systematic practice in the urine analysis for sugar, and partly to a better judgment in the administration of food. I do not propose to enter extensively upon the treatment of diabetes, but especially to dwell upon a few facts which are of importance in determining a proper management. In the first place, it is impossible to ascertain the value of any treatment without an accurate determination, not merely from time to time, but frequently, of the percentage of sugar eliminated in the twenty-four hours urine; because in this way only can we judge of the actual progress of our cases. Thanks to modern teaching, the majority of graduates of the medical schools of to-day can make such urine analyses, but there are still too many who rely only upon qualitative testing, and, I am sorry to say, there are a few practitioners who do not seem to be able to test for sugar at all; by which I mean, not that sugar is so often overlooked as that the presence of sugar is inferred when there is no reaction to justify it. I will not go into this matter now; the fact remains that I not so very rarely have sent to me patients who are supposed to have sugar in their urine when I have found none.

It is needless to say to this Society that the dietetic treatment of diabetes mellitus is far more important than the medicinal treatment and it is to this that I will more especially confine myself. The first thing to be done with a diabetic patient is to ascertain what capacity for assimilating sugar and starch there remains in him. Certainly the most satisfactory method of determining this is by giving the patient a definite weighed quantity of protein and carbohydrate food, the diabetic test meal as it were, and studying the urine during its use.

It is not necessary, however, to be so precise as this and it is seldom practicable for the general practitioner to give definite weights of food. It has been said that a physician who is not in the position to be able to do this ought not to treat diabetes. This is, to say the least, an unfortunate statement, for its adoption would lead to the sacrifice of many lives on the altar of an unfounded opinion. It is sufficient, for instance, to direct your patient to take for breakfast a

cup of coffee with cream but without sugar, a couple of eggs and a small piece of bread, say three inches square, with butter; for dinner a dish of soup without vegetables, as much meat as desired, with such green vegetables as spinach, cabbage, lettuce and string beans. For supper a cup of tea without sugar, and, if desired, some oyster broth or clam broth made without milk or flour. This diet should be kept up for three days; at the end of which time the urine should be examined for sugar. If no sugar is present it is proven that the patient is able to assimilate as much carbohydrate as is contained in the food allowed. If that is the case it is evident that no further restriction is required and the quantity of the same kind of food may be increased until the patient is satisfied. Other articles may be added of a kind low in carbohydrates, one at a time. Among articles thus added may be milk, green peas, asparagus and potato. If, after analysis with such addition, sugar is present, the particular article added should be again eliminated. If, on the other hand, the urine passed during the administration of the meals as first arranged contains sugar, then the bread should be reduced, cut out or substituted by gluten breads more or less pure. Such elimination and addition being tested by analysis, it is evident now why we have insisted upon the physician being able to make quantitative analyses, because by these alone can he determine where he stands.

It is astonishing what may be accomplished by so simple a method as this in many cases. It is true the cases most benefited are the mild ones; but I have many noted in which, by so simple a method as this, the sugar is made to disappear from the urine and the patient becomes practically well; even able to eat considerable quantities of carbohydrate food, and in fewer instances to be altogether indifferent as to diet. At the same time, it is wise to prohibit even such patients from using sugar except occasionally, and that in small quantity. A further encouraging fact is this, that in my experience so long as the quantity of glucose in the patient's urine does not exceed 2 per cent. he is in no danger. In such a case, in which the patient is on a sufficiently liberal diet to furnish the proper number of calories of food, he should occasionally be put on a diet as free from carbohydrate as possible, in order that for a time the glucose shall be at a minimum. I say an abstinence as complete as possible, because in point of fact there is really no absolute carbohydrate free food; even meat, eggs and the greenest vegetables containing minute quantities, so that under the

most completely ordered diet at least ten to twenty grams of carbohydrate daily must be taken. von Noorden recommends that these patients be subject to a three weeks' course of such abstinence from carbohydrates at least twice, and if possible three times a year, while in the intervals a certain amount of carbohydrates may be allowed. In my own experience I do not find that this period of complete abstinence need be as long as von Noorden suggests, but it should be more frequent, thus say once a month, I am often in the habit of cutting down the diet to as complete abstinence from carbohydrates as possible for from forty-eight to seventy-two hours.

At this point I may refer to the warning raised by some authors against the dangers of a too exclusive protein diet lest it produce diacetic and oxybutyric acids, the supposed causes of diabetic coma. I believe this fear is exaggerated. In the first place, it has just been said that a pure carbohydrate free diet is impossible. In the second place, I know of no good authority who does insist upon a pure carbohydrate free diet as a permanent matter. Finally, diabetic coma does occur when the patient is on a pure carbohydrate diet and there is reason to believe that the acid toxins referred to arise as much from the fixed as from the circulating proteins. On the other hand, there comes a time in every bad case of diabetes when it matters not what the food is, sugar appears in large quantities at the expense of all forms of protein as well as of carbohydrate; an irresistible demand for sugar without a corresponding consumption, when it is better to permit a mixed diet regardless of its carbohydrate contingent. Even here, after a time, if the patient improve, it becomes desirable again to resort to the more stringent diet. In this connection I should like to quote von Noorden, than whom there is no better authority, and who says, "I can only say that in the case of a thing upon which so little calculation can be made as the occurrence of diabetic coma and in view of the fact that coma has been observed under all forms of diet we should be very careful how we use the word favor. Only an extensive critical comparison of statistics, which has never yet been made, could give objective support to this opinion, and put to one side the subjective judgment of the physician theoretically disposed to one or other view. Such cases prove absolutely nothing."

While the dietetic treatment of diabetes mellitus is by far the most important, it is to be remembered also that a proper hygiene is only second in importance. Such hygiene includes muscular exercise

by walking and hill climbing, or even gymnastics short of fatigue, by bathing and friction of the skin. Cheerful surroundings are also of great importance, as depression of spirits is especially unfavorable, and all possible should be done to cheer the patient and occupy him mentally.

But it is perhaps the medical treatment which is most anxiously inquired after, both by the patient and the physician. Yet it is really the most disappointing because here again there are no recent additions to the drugs of any value which have been more or less associated with the treatment of the disease. In the first place, there is only one drug which I know is capable of reducing the quantity of glucose in the urine of a case of diabetes mellitus and that drug is opium. All preparations of opium have this effect. But the gum opium is probably the most efficient. Codein, however, suggested by Pavy, has become the most popular preparation chiefly because its use is unattended with the unpleasant effects which belong to the other preparations of opium, although it is both more expensive and less efficient. There is reason to believe that it is by quieting nervous irritability that opium acts favorably. It may be presumed, therefore, that any drug which has a similar tendency such as the bromides, belladonna, hyoscyamus, etc., might be useful. In point of fact they are not; rarely the bromides may have a slight influence. Recent discoveries as to the relation of adrenalin to sugar formation have as yet led to no practical results. It will be remembered that studies upon this subject led to the belief that if a substance could be found which would promote the oxidation of sugar in the blood, it would be a cure for diabetes. Unfortunately none as yet has been found.

Of the remaining drugs there is only one in which I have any confidence and that is arsenic. I do think that the continuous use of small doses of Fowler's solution does favorably influence the course of a diabetes mellitus; whether as a tonic or as a promoter of oxidation I do not know. It may be that it operates in the latter way. Other tonics are of course indicated; such are iron, strychnin and the simple bitters. Iron, unfortunately, too often tends to make the patient constipated and constipation is a very unfavorable complication of diabetes. There is no better determined fact than that diabetes complicated with obstinate constipation is a very unfavorable form.

The alkalies are useful in diabetes not so much as remedies as a protection against its more serious complications, the acid intoxications,

and I think it a very good idea to have a diabetic patient more or less constantly under the use of alkalies either in the shape of the citrates or the carbonates of potash or the natural alkaline mineral waters. This brings me to the matter of the treatment of diabetes at mineral springs, such as Vichy, Carlsbad and Neuenahr. It is not unlikely that the aperient properties of Carlsbad water by relieving the liver and intestinal canal of torpor acts favorably in diabetes, and that Vichy water operates favorably through its alkalinity. But perhaps the chief advantage of these places lies in the relaxation, the freedom from care, the regular diet and the improvement of the hygiene of the individual.

For the complications the most important treatment is that directed to the disease itself. This relieves the pruritus, the eczemas, the tendency to boils, although the usual local remedies for these conditions may be employed. As we have already intimated, for diabetic coma the indication is to alkalise the urine as thoroughly and as quickly as possible. Without doubt temporary benefit is obtained from the intravenous or subcutaneous injection of salt solution or, better, of weak alkaline solution; but while a reviving effect undoubtedly follows such use I have never seen any permanent benefit. Greater possibilities exist if the attacks can be anticipated and combated by large doses of the alkalies. With a view to such anticipation it is of the greatest importance that tests should be made for aceton and diacetic acid almost as often as for glucose. The sodium nitro prussid test for aceton and the iron chlorid test for diacetic acid are easily applied. In threatened diabetic coma, six or eight grams (90 or 120 grains) of sodium bicarbonate or potassium citrate may be used daily, dissolved in Vichy or Neuenahr water.

DISCUSSION.

DR. FREDERICK P. HENRY: It is, I believe, universally acknowledged at the present time that it is impossible to classify diabetes mellitus as a distinct morbid entity; that is a disease dependent upon a specific infection or associated with definite anatomic lesions. We must, therefore, regard it as a state of malnutrition. It is, of course, generally agreed that the chief exciting cause of diabetes mellitus is the abuse of farinaceous and saccharine substances, leading to the exhaustion of the power of the organism to assimilate and consume them. It is stated, by de Renzi, that in Genoa, where the diet of the people consists largely of meat, it is difficult to obtain a case of diabetes for clinical purposes; while in Naples, where farinaceous foods are the staple articles of diet a physician in large practice may have from 20 to 30 cases of diabetes mellitus under observation at one time. Diabetes begins with noncombustion of a fraction of the in-

gested carbohydrates, the larger portion being consumed. By degrees, more and more sugar appears in the urine until there arrives a stage when the amount of sugar in the urine is the exact equivalent of the amount of carbohydrates ingested or may even exceed it. It is, therefore, no privation to the diabetic to eliminate carbohydrates from his diet, for they serve no useful nutritive purpose. While there may be a craving for carbohydrates on the part of the patient it is probably the result of habit. These articles of food have, however, their use in diabetes and a very important one. As is now generally recognized, they limit or prevent the formation of the aceton compounds. The theory of Ebstein regarding diabetes seems to me the most reasonable that has yet been presented. Ebstein having ascertained by ingenious experiments, that the presence of carbonic acid inhibits or retards the conversion of glycogen into sugar outside of the body, employs this fact to explain the noncombustion of sugar by the diabetic organism. He supposes that diabetes is due to a general alteration of the protoplasm of the body, in virtue of which, from a given amount of carbon containing substances, it produces less than the normal amount of carbonic acid. This deficient production of carbonic acid does not suffice to restrain the action of the diastatic ferment upon the glycogen stored in the system and especially in the liver and muscles. In consequence, there is an excessive production of sugar, with resulting glycemia and glycosuria. Dr. Tyson spoke of getting rid of the sugar in the urine, as if this were easy. It is a simple thing to get rid of the sugar in the urine in the ordinary alimentary forms of glycosuria, but there are forms of glycosuria in which it is impossible to get rid of it; cases in which sugar is formed not only from carbohydrates but from protein. In these cases treatment, so far as the suppression of glycosuria is concerned, is of little avail. Dr. Tyson also spoke of the importance of tests for sugar in the urine, and especially of the importance of quantitative tests. We are all agreed concerning the value of these tests, but it seems to me far more important to obtain a test for aceton that is easily applicable, for it is well known that while the percentage of sugar in the urine may not vary, the aceton bodies may increase and coma result when, relying solely upon our sugar tests, we are misled into the belief that the patient is holding his own or even improving. The simplest test for aceton is its odor, but when we are able to smell aceton in the breath of the patient the case is far advanced. According to Fagge, the late Dr. Babbington could detect a case of diabetes among a group of patients by his sense of smell. As above stated, however, such cases must have been far advanced. Diabetes has been divided into 4 varieties by Hirschfeld: (1) Cases in which only a fraction of the ingested carbohydrates is excreted; (2) cases in which practically all the carbohydrates is excreted as sugar but in which the acetonuria is not above the normal amount; (3) cases in which all the carbohydrates is excreted and the aceton bodies are increased; (4) cases in which there are digestive disorders with colicky pains, and in which disease of the pancreas may be, therefore, suspected. This classification is neither etiologic nor pathologic, but is based upon the clinical course of the disease. In short, it is quantitative, not qualitative. It is, in my opinion, the only kind of classification which, with our present knowledge, we are warranted in making. In the treatment of diabetes, muscular exercise is an important agent. By its judicious employment sugar may be made to disappear from the urine in mild cases, even though carbohydrates be still consumed, and severe

cases may be diverted into a benign course. If aceton is present, however, exercise may be productive of harm, and should only be prescribed when it is proved to diminish the formation of the aceton bodies as well as the excretion of sugar. I do not recollect whether Dr. Tyson spoke of fat, but it is stated by all authorities that this is best given in the form of butter and 100 gm. a day has been suggested as a minimum amount. Fat supplies the system with an oxydizable material which is converted into carbonic acid and water without the production of sugar at any stage of the transformation. I am convinced of the benefit of alkalies in diabetes. They were the only drugs employed by Cantani, who preferred them in the form of the alkaline lactates. I recently had the opportunity of proving their efficacy in the case of a physician who found that, without altering his diet, sugar disappeared from his urine during the administration of alkalies and invariably reappeared when they were discontinued. The drug upon which I rely the most is opium. It obtunds the senses of hunger and thirst, tranquilizes the nervous system and undoubtedly diminishes the excretion of sugar. This, of course, may be due to the diminished appetite which it induces, rather than to any specific effect upon the glycolytic process. There is little danger of acquiring the opium habit which, however, is better than the habit of excreting sugar in the urine. Alcohol is another substance that I believe to be beneficial by preventing the "autophagy" of the tissues. I permit my patients the use of tobacco for reasons similar to those which lead me to prescribe opium. It has no curative effect but soothes the nervous system, relieves the sense of hunger and is generally conducive to their well-being. Cases of glycosuria in children under two years of age are not common. With reference to Dr. Ellis' remark about diabetic coma not being well understood, this, of course, is true, but it does seem to me that we know more about it than any other symptom of the disease. We know positively that it is due to acid intoxication.

DR. H. A. HARE: One would be inclined to think that the number of cases of diabetes met with in men and women is nearly equal; yet, statistics taken from a large number of cases show that this is very far from correct, and that nearly 83.5% of the cases occur in males, leaving a fraction over 16% occurring in females. Apparently there is an extraordinary increase in the frequency of diabetes mellitus. Purdy states that in 1860 the deaths from diabetes were 72 per 100,000 persons; in 1870, 98 per 100,000 persons; in 1880, 170 per 100,000 persons. He also states that the greatest increase in the frequency of diabetes according to the statistics of the last 50 or 60 years was between 1860 and 1870, which was the decade of the Civil War and its consequences and he asks whether the nervous stress and strain and excitement could have had anything to do with producing the remarkable increase. He, however, thinks that this increase is not so much due to the nervous stress as to the fact that toward the end of the decade the people in the United States, notwithstanding the war, were eating and drinking more heartily of foods and wines which carried a certain amount of sugar. A few years ago I published a brief statistical note, in which I said that the relative frequency of diabetes compared to other diseases, in hospital practice, was 1 in 540. I am convinced that diabetes is much more frequent amongst the well-to-do than amongst the lower classes. Those of us who read von Noorden know that he recommends that butter be thoroughly washed in order that the fatty acids may be removed. Under these circumstances he considers the butter

less capable of producing serious effects. If there is any truth in the theory that potatoes are a good diet it would seem that butter might be taken with potatoes rather than with bread. I think it is of very great importance to recognize the relationship between threatened or actual diabetic coma and the regulation of the diet. In the light of our present knowledge we know that water is not to be cut down and that carbohydrates should be administered the moment that acetonuria indicates the danger of coma. Dr. Edsall, who is well qualified to speak upon this, can tell us why levulose can be utilized in diabetes better than sugar. I know of cases in which the patients have had diarrhea, which they have been told must not be checked. (He referred to such a case.) I do not agree fully with Dr. Henry in the value of the alkalies, unless the case is one manifestly gouty. I have the greatest confidence in the use of codein, morphin and opium. Some cases are largely controlled by the use of codein, more difficult ones by morphin and in other cases opium will produce a result which neither of the other will produce. I also disagree with Dr. Henry in his statement that we know much about the coma of diabetes. We may say that such a patient has acidosis, that he has increased oxybutyric acid in his blood or other part of the body, but I think this is not a clear conception of the actual cause of diabetic coma. I think it is not a sufficiently recognized fact that diabetes, like asthma, is a symptom, and not a disease; that there is no such disease entity as diabetes. When a man comes to me suffering from diabetes, I no more think that he is suffering from a disease entity than in a case of headache. The cases of diabetes seen in overfed club men and wealthy Israelites is of a different type from that which comes on in individuals subject to some prolonged mental strain or the result of a profound shock, or in those who have a gouty heredity. A sharp line should be drawn between alimentary glycosuria and diabetes. I believe that glycosuria is curable and that diabetes is absolutely incurable, although it may be modified by treatment.

DR. JUDSON DALAND: In the dietetic treatment of diabetes we must take a broader view than has heretofore been taken looking to the restoration of the digestive power of the individual. Acetonuria is important not so much because it points to oncoming coma, but because it indicates abnormal metabolic process s within the body. From my experience in India this summer and from conference with a number of men throughout India, where I find that meat is eaten to a very small extent or not at all, I am able to say that this disease is exceedingly common. I believe that the management of this affection has undergone a revolution and that to-day we have greater success in its management than formerly. I have also found that in many of these cases the use of the alkalies is of distinct advantage. My own experience bears out the statements regarding the increase in frequency of diabetes.

DR. J. ALISON SCOTT: The glycosuria of pregnancy, referred to by Dr. Boston, our obstetrical friends, from a great deal of experience, consider a mechanical glycosuria. In many of the cases careful examination proves that the sugar excreted is levulose and not glucose. There is often in pregnancy, however, a true glycosuria. I have been able in recent years to follow several cases of that type and I have definite notes of two. One was a woman, confined 8 years ago, who presented for 2 weeks after her confinement a considerable amount of glucose in her urine. It then disappeared and for several years she continued

in good health. However, she removed from the city, and came under another physician's care; within the past 4 months I was asked to see her and found that at about the first of the year she began to have rapid emaciation, polyuria, thirst, hunger, etc., and now has all the evidence of an active and severe diabetes. The second case was one in which the excretion of sugar preceded the labor for several months and disappeared after the birth of the child. That was 5 years ago, and the woman has continued in good health. The child born at the time of the glycosuria seems to show evidence of the development of disease. There is no sugar in the urine, yet the child is one who has incontinence, an excessive appetite and polyuria. Cases of gout, it seems to me, at times more frequently than other varieties of disease present sugar in the urine and I have histories of several cases in which the joints have shown evidence of gouty deposits. In such cases, oftentimes, a very acute serous diarrhea is followed by the entire disappearance of the sugar from the urine; the glucose reappears slowly after the patient returns to an ordinary diet. The patients do better on a rather full diet than on a restricted one. I have the notes of the case of a boy who developed all the symptoms of severe diabetes 2 years ago; the symptoms disappeared in a short time under appropriate treatment. The boy, who was 21 years old, felt perfectly well, yet the urine contained from 7 to 10% of sugar, and measured from 48 to 50 ounces in the 24 hours. Vigorous exercise was followed by hematuria, without casts and without increase of the sugar. This symptom cleared up in 24 or 48 hours. Therefore, in a considerable number of cases of what we call diabetes, with classical symptoms, we cannot rely upon the persistence of these symptoms for the diagnosis; under appropriate treatment the thirst, polyuria and hunger disappear but there may still be a large quantity of sugar present in the urine.

DR. JOHN M. SWAN: A patient who complains of boils should be required to submit a specimen of urine for examination for glucose. Boils are usually considered late complications of diabetes; but now and again cases are met with in which they are the only suggestive symptom. It is now generally admitted that a patient with glycosuria, whether alimentary or that of a true diabetes mellitus, requires a certain amount of carbohydrate substance in the diet. I have recently read in the *Intercolonial Medical Journal of Australasia*, August 20, 1905, that Lidwell gives his diabetic patients bread made from black rye flour, or "pumpernickel," instead of bread made from white wheat flour. This rye bread contains 73% of starch; but Lidwell found that diabetic patients who ate this bread showed no increase in the amount of sugar—indeed, in some cases the sugar entirely disappeared from the urine. To ascertain why bread made from flour with so much starch could be safely eaten by a diabetic patient he subjected the bread to artificial digestion and it was found that only 10 or 12% of the starch was converted into dextrose. He claims that such bread satisfies the desire of the patient for bread.

DR. EDSALL: There are two points relating to the examination of the urine to which it is worth while to refer. One Dr. Scott has mentioned, namely the glycosuria of pregnancy and the lactation period. In most instances of this sort that I have had referred to me I have found milk sugar, an observation that modifies the whole character of the diagnosis and prognosis as well as the treatment. The point that I have had most frequently referred to me, however, is to determine what is the matter when there is a reaction that resembles sugar,

but is not certainly sugar. I find that in almost all cases the person who gets a doubtful reaction with Fehling's solution forgets that if the urine does not undergo fermentation there is no dextrose present. Fermentation is not only often a distinctive test; it is a very easy one. Dr. Henry, Dr. Hare, and others referred to the distinction which should be made between true diabetes and those conditions in which there is more or less persistent glycosuria which does not give rise to the symptom complex of diabetes. These conditions are, as a rule, distinct from progressive diabetes. On the other hand, one should be wary of making a very gross distinction and of allowing the patient liberties. It is not infrequent to see cases of glycosuria of this form ultimately become essential diabetes and it is necessary to make the patient undergo some restrictions and to exercise care about the use of carbohydrates. I have, for example, a patient now under my care, who, his doctor tells me, had temporary glycosuria 8 years ago, and several times since. His apprehensions were quieted. He was allowed considerable freedom in diet, and in business strain and now the case has developed into a mild but definite diabetes that responds to treatment in a very unsatisfactory way. Some emphasis ought to be laid upon the wisdom of not dismissing such a case as one of mere "glycosuria" of slight significance. As to the causation of diabetic coma, I think there is very little doubt, so far as we can now tell, that the coma is due to acid intoxication and that this intoxication may occur in other diseases. The most important practical point concerning this intoxication is that we should not wait for the appearance of coma or impending coma, but should carefully watch the urine for reactions for aceton and diacetic acid and, if possible, make quantitative estimations of the ammonia in the urine. It is of great practical interest that Shaffer has recently described a method which permits a quantitative determination of the ammonia in about 15 minutes, and which appears from his description to be reasonably accurate. If ammonia is present in amounts above 2 gm. in the 24 hours the patient must be considered to be in danger of coma and should be treated by modification of the diet and the use of alkalies.

DR. BOSTON: In order that there may be no misunderstanding in regard to the 8 cases of glycosuria in children under 2 years of age I might have added that 4 of the children were related. Three of the cases were collected by my uncle, Dr. H. C. Bacon, and another one by my brother, Dr. C. L. Boston. One of the specimens came from Montana and another from Minnesota. They were not cases that I saw personally; but the specimens of urine were sent to me for examination, and I obtained brief histories of the cases from the physicians who referred them. It seems to me that it is often difficult to be positive about the presence of sugar when one depends upon the copper reaction alone.

DR. JAMES TYSON: I wish only to refer to the importance of testing for aceton and diacetic acid. It is almost of as great value as testing for sugar. The sodium nitroprussid test for the former and the iron chlorid test for the latter are both easy of application. I want also to add my voice to what Dr. Edsall has said in regard to alimentary glycosuria. I am sure that if these cases are left alone they do pass over into true diabetes. Therefore, for practical purposes, it is just as well to consider them as cases of diabetes

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

The Operative Treatment of Fractures of the Patella.

By John H. Gibbon, M. D.

[Read October 25.]

The treatment of fractures will always remain a subject of great importance to general practitioners as well as to surgeons, and largely because of the responsibility which attaches to their treatment. Therefore, I have no apology to offer for bringing before this society the important subject of the treatment of fractures of the patella. This fracture has always been one of the most difficult to treat and one which has given us the poorest results. This is due entirely to the difficulty, in most instances the impossibility, of obtaining thorough coaptation of the fragments. This difficulty arises from two factors, first the fact that there is attached to one of the fragments a powerful group of muscles which, unless properly controlled, constantly tends to separate the fragments, and, second, to the interposition of ligamentous or tendinous structures between the fractured surfaces. The latter of these interfering elements is by far the most important because it is impossible to overcome it without an operative interference that carries with it some risk. It shall be my object to show that this risk can be taken with impunity *provided* the operative interference is carried out in an absolutely aseptic manner. Unless this latter condition pertains the risk is undoubtedly very great and should never be encountered.

At one time it was thought that only in fractures due to direct force were the fragments of the patella covered by the torn ligament, but now that these fractures are being operated upon more frequently we find that the ligamentous structures are interposed between the fragments in practically all cases, whether the fracture results from direct force or from muscular action. In every case I have operated upon I have found the torn ligamentous tissue adherent

to one or the other or both of the fragments. It is the upper fragment which is most frequently covered in this way. This condition I have met with both in the early operations and in those which have followed unsuccessful treatment on the splint. It is undoubtedly this interference with absolute bony coaptation of fragments that has rendered the ordinary method of treatment on the splint and in casts unsuccessful. If it could be eliminated I believe there would be little cause for operative interference. By rubbing the two fragments together it may be eliminated to some extent, but in many instances I have had to use the periosteal elevator or some similar instrument for the purpose of separating the fibrous tissue from the fractured surfaces.

It has recently been shown that in operating upon these fractures it is even more important to suture the torn lateral ligaments than to suture the patella itself. Where these ligaments are ruptured, and they are ruptured in practically all of the cases, whether the fracture be the result of direct violence or of muscular action, their torn edges will be found to be separated from one-half to one inch. The difficulty of approximating these torn structures by any method of splint or other dressing can readily be appreciated. Still another feature that renders mechanical coaptation uncertain and difficult is the occurrence of multiple fracture. With so small a bone broken into more than two fragments close approximation is most uncertain. By the operative method of treatment such fragments can easily be brought into close relation.

The tear of the lateral ligaments is always accompanied by the effusion of a large quantity of blood which fills the joint to a degree that frequently renders even an imperfect coaptation impossible until absorption has taken place. This absorption, unless it is prompt, results in adhesions which, if not prevented by massage and early passive motion, are a potent factor in limiting the subsequent movements of the joint.

The methods of operating in fractures of the patella are innumerable and range from subcuticular sutures of various types to the complete exposure of the fractured bone and torn ligaments. It must be remembered that the torn ligamentous structures are of as much, if not more importance, when repair is considered, than the fractured bone itself. There are certain methods of treatment which may be classified as "intermediate," that is, between the expectant, nonoperative or splint method and the operative method. I refer to the use of

Malgaigne's hooks, the passage of needles transversely through the quadriceps extensor tendon and the ligamentum patellæ, the fragments being drawn together by traction on the two needles, and other methods of similar principle. All these plans of treatment have had their time and have served to lead to the later and better procedures. The various forms of subcutaneous sutures which have been tried are all open to the same objection, viz., the danger of infection, and possess none of the chief advantages of the open method. It is nearly impossible to be sure that these subcutaneous sutures do not enter the joint itself, and if they do the chance of infection is, I believe, greater than where the open method is pursued. Stimson's experience illustrates this point very well. Between the years 1889 and 1892 he employed subcutaneous suture in about forty cases: he had two infections which were followed by stiff joints. Between 1892 and 1905 he operated upon about two hundred cases by the open method and had but one slight suppuration which produced no subsequent difficulty. All the patients of the latter series, he states, have useful joints. The open method of treatment may be divided into three classes: those in which the bone alone is sutured; those in which the ligamentous tissue alone is sutured; and those in which both are sutured. Experience has shown that suture of the bone alone is not to be employed. The choice lies then between the second and third types of operation, and the tendency of most surgeons lately has been to simply suture the fibrous tissue and the lateral ligaments over the patella, and not to penetrate the bone at all. Blake has advocated and practiced simple suture of the lateral ligaments and has obtained good results. In all but two cases I have sutured the bone as well as the torn tissues about it, but the results were practically as good in the two cases in which the bone suture was omitted.

The time at which the operation should be done is a matter about which surgeons have differed. Blake and others have advised waiting a few days until the local acute symptoms have somewhat subsided. I am not sure that this is the best plan and will be inclined in the future to operate as soon after the injury as possible. In my last case, done about four weeks ago, I operated within a few hours after the injury. If the operation is not done at once measures should be employed to prevent the effusion, or to cause its prompt absorption if it has already taken place. Nothing accomplishes this so well as compression, either by tight bandage, elastic bandage or sponge

pressure. Personally, I like to apply a tight muslin bandage to the joint and place over this one or two icebags.

The incision employed in all the cases shown to-night was either a slightly curved transverse incision or a U-shaped incision. The incision should pass across the knee a little below the line of fracture in order to prevent adhesion of the skin and superficial tissues to the line of fracture. If the skin incision is immediately over the fracture it is apt to become adherent and, in case of refracture, the skin will nearly invariably tear across, rendering the new fracture a compound and not infrequently an infected one. The transverse incision gives a perfect exposure of the torn lateral ligaments, such as is very difficult with the straight incision. In dissecting out distended prepatellar bursæ this incision is far superior to a straight one, as it enables the operator to dissect out easily every ramification of the bursa.

When the incision is made and the joint opened it should be acutely flexed and all free blood and blood clot carefully removed with forceps or with sponges. Some surgeons recommend thorough irrigation of the joint with hot salt solution, and I have employed this when there has been difficulty in getting rid of the clots. In many of the cases, however, it is unnecessary. The least handling and manipulation of the injured parts and the joint the better, in fact, the necessary manipulation of the structures should be done in the simplest and most delicate manner. Rough handling greatly increases the possibility of infection. It has been my experience that in every case the upper fragment, at least, has been covered by fibrous tissue, which should be carefully lifted off with an elevator or some similar instrument. This fringe of tissue should be carefully sutured to the corresponding edge covering the lower fragment.

The sutures should be of an absorbable material, and there is nothing better than chromicized catgut. There is no longer any reason or excuse for employing silver wire in the treatment of this fracture. Absorbable sutures keep the fractured surfaces together for a sufficient length of time for good union to occur, and if it does not occur in this time no silver wire suture is going to add any additional strength, and it does undoubtedly give subsequent trouble in a certain number of cases. It is not necessary to use very large gut. Personally, I employ a double thread of a smaller size rather than a single large strand. If the bone itself is to be sutured the opening should be made from the outer through to the fractured surface, but

should not penetrate the articular surface of the bone. It is only necessary to introduce one or two of these sutures. The lateral ligaments should next be sutured and then the fibrous tissue over the bone. Care should be taken that the sutures are not tied too tight, as a tight suture always renders tissues more prone to infection. Having seen the satisfactory results obtained in the two cases in which I did not put a suture through the patella itself, I think in the future I shall eliminate this part of the operation and suture the lateral ligaments and fibrous tissues only. The skin wound should be closed with silkwormgut sutures and no drainage employed. In some of my earlier cases I used a superficial gauze drain at each extremity of the incision, but I am now convinced that this is unnecessary, and in my late cases have not employed it.

The leg may be dressed either upon a posterior splint or put immediately into a cast: I always employ the splint. An important feature in the after-treatment of these cases, whether the leg is dressed upon a splint or put in a cast, is the elevation of the leg for the purpose of relaxing the quadriceps extensor muscle. Where the leg is thoroughly elevated it is impossible for the muscle to contract sufficiently to affect the fracture. The part should not be touched for a week, when the stitches are removed. After this very gentle massage and slight lateral movement of the patella may be employed. After three or four weeks the splint can be discarded while the patient is in bed and massage regularly employed. After six weeks there is no longer any necessity for the use of the splint excepting as a protection in case of a fall. Passive flexion of the leg can be begun after the fourth week. After eight or ten weeks no dressing whatever is necessary, but the patient should be cautioned to avoid a fall. Flexion of the leg should be encouraged at this time.

Aside from the advantages to be derived from a perfect coaptation of fragments the operative treatment offers the additional advantage of a much shorter convalescence with a much earlier return to work. Two of the latest and best works on fractures recommend that in the nonoperative treatment some form of splint should be worn from six to ten months, whereas after the operative treatment, it is stated, there is no necessity for any form of restraint after the third month. In my own cases it has been discarded much earlier. The tendency in the treatment of all fractures of late years has been to discard the splint early and to institute regular massage, with gentle passive movements; the results have been correspondingly better.

I have recently examined my last seven consecutive cases treated by the open method and all of them have perfect bony union, six have good function and the seventh gives every prospect of having it: it is now four weeks since his operation. Five of these patients were operated on at the Pennsylvania Hospital, one at the Polyclinic Hospital and one at the Bryn Mawr Hospital. There was no infection or other complication in any of them. In two of them, one a man of sixty-three and the other a woman, the flexion is not as complete as in the other cases. All of the patients have been able since operation to return to their usual vocations and have no difficulty. One of them is a paperhanger and continues to work at his trade without any discomfort. Two of the patients were over sixty years of age, and the results could hardly be better. Skiagraphs have been made of a number of these patellæ after operation and a close coaptation of the bone demonstrated. Several of the patients have complete flexion of the leg.

Although I admit a certain amount of enthusiasm regarding the operative treatment, I cannot close without confessing that its application should only be undertaken in a well-appointed operating room and by a surgeon who has developed, and whose assistants have developed, what may be called an "aseptic habit." If suppuration should take place in the knee joint after an operation of this kind a stiff joint at least is apt to result, and loss of the leg and death have occurred. I think that when we learn to look upon this operation as we do upon abdominal operations and perform it with the same care its field of usefulness will greatly increase. Stimson, whose experience is probably as large as that of any other surgeon in this particular line of work, states that although he invariably practices the open method he is not prepared to teach it. It must be admitted also that when the nonoperative treatment is properly and carefully carried out there is practically no risk to limb or life and the ultimate results are more or less satisfactory. These results, however, do not compare with those obtained by the open method and, as has been shown before, the period of convalescence by the nonoperative treatment is twice that of the operative method. Refracture occurs after both treatments, but is much more frequent in the cases not operated upon. Personally, I should not hesitate a moment as to which method I should have employed in my own case.

DISCUSSION.

DR. JOHN B. SHOBER: I have been interested in this fracture since the time I had the honor of being Resident Physician at the Pennsylvania Hospital, in the year 1886. I remember at that time, just after the beginning of antiseptic

surgery, that I had under my care 5 cases of fracture of the patella, in the service of the late Dr. Thos. G. Morton. One was treated by Malgaigne's hooks, 2 on the Agnew splint and in the other 2 the fragments were united with silver wire. Since that time the technique of the open method has been greatly improved, and our present success is due to the fact that less attention is given to approximating the fragments and more to uniting the lacerated ligaments and capsule. Little attempt was then made to free the overlapping fibrous tissue, the whole attention being given rather to coaptation of the bones by using silver wire. One of the difficulties encountered was the upward tilting of the fragments because the ligaments were not properly cared for. As Dr. Gibbon has so truly said, the fragments will take care of themselves provided the torn ligaments and capsule are properly united, and he has very properly thrown out a timely warning, in stating that the operation is a serious one and should be undertaken only under the conditions which he has pointed out. It is now generally admitted that the use of Malgaigne's hooks and the various subcutaneous suture methods are not only unsatisfactory but quite as dangerous as the open operation. They may now be considered obsolete.

DR. JOHN B. ROBERTS: Dr. Gibbon has shown the defect in the operation in that he is afraid to teach it to his students. I feel that if we have all the advantages of good assistants, good operating rooms, etc., it is a very satisfactory operation. but, what we want in our treatment of fractures is something that the average man can do, so that we will not have to send all our patients to the experts. I believe that this is a good operation. I would be perfectly willing to operate in this manner upon any number under the circumstances spoken of, if I did not believe there was a simpler operation which can be done, with a reasonable expectation of having no sepsis, even if not done by experts. A long needle with thread is inserted and run around the patella subcutaneously without going into the joint, so as to carry by 4 punctures a purse-string suture around the bone horizontally as the patient lies on his back. You have practically all you want in the subcutaneous purse-string suture. Care must be taken to sterilize the skin, the needle and the thread. I endeavor to get rid of the fascia and periosteum that falls in between the fractured bone by rubbing the bones together. At the end of 3 weeks the knot is cut and the string pulled out. In a short time there is perfect flexion and extension. The operation is so simple that it ought, in the hands of most of us, to take the place of these more serious operations, which we only dare undertake under ideal conditions. What would Dr. Gibbon do in cases in which there is visceral disease, or in which the patient is too old to have an open arthrotomy?

DR. WILLIAM L. RODMAN: It seems to me that the operation described by Dr. Roberts is dangerous because of the difficulty of disinfecting the skin. The small opening in the skin may carry in infection and it does not provide for drainage. I believe a subcutaneous operation is more dangerous than aseptic arthrotomy. I have been operating on fracture of the patella for 10 years. My feeling is that the operation should be surrounded with restrictions in old subjects or in patients with visceral disease, and that it should be confined to young men who must lead very active lives. While I have never had a bad result from open arthrotomy, I always feel it my duty to tell every patient of the danger, because sometimes a limb or a life may be lost from infection. Another reason

why the subcutaneous operation will never, in my judgment, be perfectly satisfactory, is the fact that the soft structures get in between the ends of the bone and these cannot be eliminated except by open operation. Never but once have I gone into a joint in which I did not feel convinced that a perfectly satisfactory result could not have been obtained in any other way. I think that the curved linear incision is better than the straight incision of Stimson, and I think that it should be below the line of fracture rather than on a level with it. I think that it is unnecessary to wire the bone. It has seemed to me best to wait until many of the acute inflammatory symptoms subside before operating, say at the end of 72 hours or later.

DR. A. C. WOOD: I think that modern surgery tends to get more and more away from subcutaneous operations. I believe that a man whose aseptic technique is not sufficiently perfect to justify him in opening a joint could not be trusted to pass a subcutaneous ligature. I formerly used a curved incision below the line of fracture, but I found it objectionable in some cases because of the discomfort when the patient kneeled or pressure was made in front of the joint if the scar remained tender, as sometimes happened. I, therefore, make the curved incision above the patella and turn the flap down. This involves a part of the skin which is thick, a part upon which practically no pressure comes, and drainage is favored when the leg is elevated, a very important matter in the after treatment. I still prefer to unite the bone as well as the capsule and the lateral ligaments. The former method of wiring the bone was to drill a hole through either fragment from the anterior surface to the fractured surface for the silver wire. This method is objectionable in theory, at least, as the twisted wire is between the front of the patella and the skin. I now introduce the drill from the lateral aspect of the circumference, bringing it out on the fractured surface, so that when the parts are brought together the knot is at a point where there is no pressure and far removed from the incision.

DR. GIBBON: I agree with Dr. Wood that a man who is not capable of doing an aseptic open operation is incapable of doing a subcutaneous operation. I feel sure that a nonabsorbable suture remaining in the parts for 3 weeks offers a very dangerous channel of infection. I think that the two cases of infection out of 40 of the subcutaneous method reported by Stimson, and the 200 of the open operation without a stiff knee speak well for the method. When an operation is not performed these cases are treated on the posterior splint with elevation of the leg. I do not think it necessary to apply traction or extension to the muscles to coapt the fragments. If the leg is elevated the quadriceps extensor muscle is absolutely relaxed all the time and the points of attachment are so close together that no muscular contraction can take place. I have used the reversed-U incision in operations for the excision of the prepatellar bursa to avoid irritation of the scar from pressure. But in the cases shown, the incision comes just below the line of fracture and the patient kneels on the tubercle of the tibia, which is below the scar. I have had no trouble with catgut now that we have learned how to sterilize it.

Two Cases of Severe General Infection of Obscure Origin.

BY HERMAN B. ALLYN, M. D.

[Read October 25.]

The following cases are reported partly because of their exceptional intrinsic interest, but mainly because they show that in some instances a systemic infection may exist without our being able to discover the port of entry of the infecting agent and its precise nature. We find a number of organs, sometimes in varying degree all the tissues of the body, involved; but cannot tell how the living infecting agent gained entrance to the body. In other words, we find a septicemia such as was familiar following childbirth or such as occurs following a poisoned wound; but can find no wound and no open absorbent surface through which the bacteria reached the circulation from the exterior.

CASE 1.—Boy, aged 4 years. Pain in the abdomen, vomiting, delirium, death in 3 days from a sudden large pleural hemorrhage. At autopsy, pure cultures of an undescribed form of colon bacillus were obtained. Arteriosclerosis was the only marked family medical trait. It was present to a pronounced degree in both parents and grandparents. The mother had had an abscess over the sacrum connected with the bone, but had fully recovered before marriage. The patient himself had always been lusty, plump and rosy. His only illness had been measles, common colds or an attack of tonsillitis, until February, 1901. At this time, when influenza was prevalent and other members of the family were ill with catarrhal symptoms, the patient, after a day or two of illness, with mild catarrhal symptoms affecting the nose and throat, began to vomit. The vomiting was accompanied with abdominal pain, restlessness, insomnia and constipation. The stomach was very irritable, vomiting occurring 12 times in one night. The material was watery, with blackish streaks. The attack lasted for 11 days, the vomiting being very difficult to control. The patient tossed from side to side, complaining of "my pain," resented any examination, refused to answer questions, and had slight wandering delirium. The temperature was rarely 100° or above. No evidence of any inflammatory disease of the abdomen could be found. The heart and lungs were normal. The entire illness lasted 17 days, and gain in strength afterward was gradual. Two months later he was brought to the office for frequent urination and abdominal pain. This pain he had complained of at intervals for 2 years. No explanation of it could be gained from an examination of the abdomen. The appendix was not enlarged or tender. The pain was located over the bladder, and was relieved by remedies to lessen bladder irritability.

I give this much of the previous history of the patient because it may be that the infecting agent causing the February attack

may have lingered in the body and later brought on the fatal illness of May, which is now to be described:

The boy seemed to be perfectly well until the afternoon of May 22d, when he complained of abdominal pain and lay down. I saw him the following day. He was vomiting, as in the February attack, was constipated, and complained of the pain. The abdominal walls were soft, there was nowhere any rigidity. Two fecal lumps were felt, one in the ascending and one in the descending colon. The lower abdomen was slightly tender, especially toward the bladder. The temperature was 99°. The patient was not irritable and fretful and did not resent examination as he had done in February. The throat was slightly congested. During the night vomiting continued. The patient was very restless and slightly delirious. The bowels were moved with the aid of a suppository and enema. The stool was formed and natural in appearance. The next day the temperature was apparently normal and the pulse good. Vomiting was less frequent. The patient had occasional cat naps for a few moments, nothing more. The skin was dry, the tongue slightly coated. That night the patient was more delirious, but roused and answered questions intelligently when spoken to. The following morning he seemed partly collapsed. The hands and legs were cold. Above the wrists and ankles the skin was mottled and streaked bluish. He rallied from this condition under stimulation, and when I saw him about 11 A. M. he was better, but the bluish discoloration remained as described. The temperature was 101°; pulse, 174. There was less vomiting. He still rolled from side to side. Nothing was to be felt in the abdomen. He said he had no pain in the head. There was slight wandering delirium. The pulse improved under stimulation. The breathing was more frequent. He continued in the same state until 3.15 P. M., when he died suddenly. Autopsy 5¼ hours after death. There was great enlargement of the mesenteric glands, some being as large as almonds. Some enterocolitis, with enlargement of Peyer's patches, one being in the stage of beginning ulceration. No perforation of the bowel. No peritonitis; appendix long and tortuous but not apparently diseased. The stomach showed an acute gastric catarrh, with blackish secretion, which might have been bismuth. The liver showed white patches of fatty infiltration. The heart and pericardium were normal. In the left pleura was about a pint of dark fluid blood, with no inflammation of pleura or lung to account for it. There was no blood in the right pleura. The spleen was not enlarged. The whole back was purplish at autopsy from neck to buttocks. Cultures made from the spleen, incised mesenteric gland and inflamed Peyer's patch showed in the 2 former a pure culture of an undescribed bacillus of the colon group, which with other forms was also present in the culture from the Peyer's patch. The pleural blood did not yield the Widal reaction, and sections from the Peyer's patch, made for me by Dr. Flexner, showed that the intestinal lesions were not those of typhoid fever. Dr. Bergey, who made the cultures for me, was not able to identify the organism more exactly.

This case is unique in my experience, and I have been unable to find another like it recorded by anyone else. There was evidently some general infection or intoxication sufficient to produce gastro-enteritis with enlargement of the lymphatic glands and to permit leakage of the blood into the pleura and subcutaneous tissues. There was no inflammation of the lung or pleura, and no injury of either. The finding of bacilli in an organ after death does not prove that that organism was responsible for the disease present, although it may be; as in my case a form of colon bacillus was discovered in pure culture in two of the organs examined, and present in the third, it is probable that it was pathogenic. Dr. Bergey, who keeps a culture of the organism, found it to react to the serum of a case of general infection of obscure origin. It is possible that at some future time definite information as to the organism and the disease which it causes may be obtainable.

CASE 2.—Boy, aged 9 months. Small patch of consolidated lung, vomiting, purpura, otitis media, arthritis, nephritis, meningitis, death. Duration of illness 25 days. No autopsy. I first saw the patient on September 9th. He was brought to the office then for a slight cold, with cough and some mucus in the throat. He had no fever and appeared to be well. He seemed to recover completely in a day or two, and was not brought back for treatment. On the night of the 15th I was sent for because the baby had vomited and had fever. There was a history indicating chill at 4 P. M. Nothing could then be detected in the chest, and only a small aphthous ulcer on the right pillar of the tonsil. The following day a small patch of dulness could be made out beneath the right shoulder blade, over which there was slightly higher pitched inspiratory sound. No cough. Temperature, 100°-102°; respiration, 70; pulse, 170-190. That evening an eruption appeared on feet and legs, which next day was visible as purpura. There were also a few spots on chest and neck. The patient vomited twice. Temperature, 104°; respiration and pulse about the same. No Kernig sign, strabismus or convulsion. On the evening of the 17th, the temperature was 105°; respiration, 50; pulse, 163. There was no increase in the area of lung involvement; but a few very coarse snoring rales were heard. The arms and legs were held somewhat rigidly and appeared tender when moved. Mental condition clear. Pupils contracted, eyes bright and clear. In the morning the left eyelid was swollen and edematous, and the left cheek red, but both were better by evening. Warm baths were ordered. Dr. Stengel, who saw the patient with me at this time, regarded the disease as an infectious purpura. The patient continued in this condition for several days. The temperature range was 101° to 104°; the respirations were frequent, from 45 to 60; while the pulse was generally below 140. On the 24th the right wrist, shoulder and elbow became swollen and very tender, and a catarrhal otitis media appeared. On the 26th he began

chewing his thumb, fretting and crying, wrinkling the forehead, and opening and closing the eyes. The right leg was drawn up, but there was no marked rigidity and no Kernig's sign. There was also some rigidity of the neck so that at times the spine was arched. There was some bronchitis of the larger tubes. Mucus was coughed up and swallowed. Some of the mucus was obtained for smears. Dr. Bergey examined them and reported finding a diplococcus, which was not that of meningitis nor of pneumonia. The patient had a short, plaintive cry, which was accompanied with frowning and opening and closing of eyes. By the evening of October 5th, he began to have some difficulty in swallowing. Convulsions appeared first on the 8th. The convulsions involved especially the left side. A lumbar puncture was made. The baby seemed to be relieved, had fewer convulsive movements, and slept more quietly. The patient died October 10th of respiratory failure of central origin. There was no autopsy. Dr. Herbert Fox reported that he found the same diplococcus in the spinal fluid that Dr. Bergey found in the sputum. Guinea pigs and a rat inoculated with the spinal fluid were not apparently harmed by it.

I have abbreviated the notes of this case as much as possible. They will, I fear, give a very imperfect picture of the case. There was evidently some general infection which lodged first in the respiratory tract, next invaded the blood and caused purpura, then attacked the joints and ear, and finally spent itself upon the cerebrospinal axis. It was not cerebrospinal meningitis; it was not pneumococcic meningitis; it was not primarily a meningitis at all, though the cerebral and spinal structures were the last to be involved and were the immediate occasion of death. My first thought was that the baby had pneumonia, but this was clearly a mistake. The lung conditon was only part of a general one, and so far as we could determine from an examination of the smears made from the throat mucus and of the spinal fluid the infecting agent was not the pneumococcus. The propriety of regarding the disease as infectious purpura seems to me questionable, as the purpura was never a dominant symptom; it faded rapidly, and did not reappear. The ear inflammation was not suppurative. There was marked tenderness on pressure in front of the ear, but not much injection of the drum head and no bulging. I examined it under good illumination, intending to incise the drum membrane, but decided that there was not sufficient local evidence of disease to warrant the operation. The child was tender and sore in a good many places, and motion, especially of the inflamed arm and of the back, was painful. The ear tenderness gradually subsided.

The disease did not impress me as rheumatic fever. The wrist,

elbow and shoulder were involved, but one joint did not cease to be inflamed when the other was attacked, there were no perspirations, acid or other, and no heart involvement.

I regret very much that no blood culture was made. It might have cleared up the obscurity surrounding the cause. I cannot regard the bacteriologic findings in this case as much more than negative. One can say only that in this, as in the first case, there was a severe general infection of obscure origin.

The lessons to be drawn from these cases seem to be: First, that we have yet to discover the cause of some general infections severe enough to cause death. This we may hope to do through the aid of the bacteriologist and the physiologic chemist. Second, that we are too prone to overlook a general infection through the prominence of some local symptom.

A New Method of Surgical Anesthesia.

By W. WAYNE BABCOCK, M. D.*

[October 25.]

In 1900 Schneiderlin advocated for the production of surgical anesthesia, the combination of scopolamin, an alkaloid of the atropin series, with morphin. As modified by various observers, from 1-100 to 1-17 grain of scopolamin hydrobromid with from ½ to 3-5 grain of morphin are given in one, or, more often, are divided into three equal doses which are injected subcutaneously at intervals beginning from two and a half to four hours previous to the operation. In from nine to twenty-six percent. of the patients there results a narcosis sufficiently profound to permit the performance of major surgical operations, but in other cases the patient is merely stupified, remains awake or becomes delirious and excitable and the procedure then becomes an adjunct to ether or chloroform anesthesia. It follows that in an overwhelming percentage of cases, the surgeon is driven to use what it may have been his desire to avoid, and the advantages peculiar to the method are much restricted.

It has been our endeavor, therefore, to find a method of anesthesia by narcotics in which the inhalation of ether or chloroform, or the use of drugs in dangerous quantities, might be avoided. Although

* Abstract of Dr. Babcock's paper.

we have succeeded in producing satisfactory anesthesia in about 70 percent. of our cases, the results fall far short of the ideal. But before presenting our results in the use of various narcotics, or considering the limitations, dangers and advantages of scopolamin-morphin anesthesia, a reference to certain of the older methods of anesthesia will be made. The literature of the past shows that one should hesitate before describing a method in which hypnotic drugs are employed for the production of anesthesia, as new or modern.

In 1894 Langlois and Marange contended that the tendency to primary or secondary syncope incident to chloroform anesthesia could be lessened by injecting ½ to ⅔ grain spartein sulphate combined with ⅛ grain morphin, ten minutes before the inhalation; but previous to this time a number of American surgeons had extensively used a preliminary injection of atropin, 1-200 grain to 1-150 grain with morphin sulphate ⅛ grain to ¼ grain as an aid to inhalation anesthesia. In order to secure narcosis from small doses of chloroform, Rabuteu experimented with narcein hydrochlorate, thebain and papaverin, and in 1893 especially commended the former drug. Narcein is such a feeble hypnotic, however, that it is probable that the alkaloid used by Rabuteu was impure.

Antedating the use of these adjuvants, surgical anesthesia had been produced solely by subcutaneous or intravenous injections, for more than twenty-five years ago Oré, of Bordeaux, anesthetized his patients by introducing a hypnotic into a vein of the arm. Using a water solution of chloral hydrate, Oré gradually injected this into the vein, regulating the dosage by the symptoms induced. For this method was claimed an absence of preliminary excitement, nausea or vomiting, and a blunting of the patient's sensibility. The brevity of the narcosis (10 minutes), the dyspnea, the occasional irregularity of the heart's action, the risk of fatal syncope, and the presence of blood and albumin in the urine after the anesthesia, were enough to throw the method into disfavor.

The prevalent belief that surgical anesthesia dates from 1846 is erroneous. There is ample evidence that patients were rendered unconscious and insensible to the pain of operations long before Morton made his immortal demonstration. Thus, in 1819, James Wardrop, of London, showed that operations could be facilitated and rendered painless by being performed during the syncope and relaxation that follows a free phlebotomy, but it is not strange that the obvious dangers and disadvantages of such a method prevented its populari-

zation. Much to be preferred is the aboriginal maneuvre of the Javanese, which consists in producing cerebral anemia and insensibility by mere digital compression of the cartoids. Previous to Wardrop's method was that of Mr. Moore, of London, who, in 1784, endeavored, with but partial success, to secure local anesthesia of a limb by compression of the main nerve trunks.

These mechanical measures, however, digress somewhat from our subject which chiefly concerns the use of hypnotic drugs for purposes of anesthesia.

In the first part of the nineteenth century, surgeons held conflicting opinions as to the employment of narcotic drugs to relieve the pain of operations. Gross writes that he was fond of using full doses of morphin which he combined, when the patient was sufficiently strong, with a moderate quantity of tartar emetic with the view of inducing greater relaxation and insensibility. This he contends was commonly productive of "great benefit, not only blunting sensibility, but preventing shock and consequently, severe reaction."

There is evidence that in the seventeenth century it was current knowledge that ancient surgeons had produced anesthesia in patients upon whom they operated, although the method seems to have passed out of practice. In Middleton's tragedy, "Women Beware of Women," published in 1657, occur the following lines:

"I'll imitate the pities of old surgeons
To this lost limb,
Who, ere they show their art,
Cast one asleep, then cut the diseased part."

The best known of ancient drugs used to produce anesthesia, was one of the solanaceæ, atropa mandragora, or the mandrake of Southern Europe. This drug contains a number of the alkaloids of the atropin series, including hyocyamin and scopolamin. Mandrake is mentioned in some of the earliest writings of antiquity, and its properties seem to have been well understood until the thirteenth century when it became lost to medicine, although knowledge of its value remained as a memory. It is believed by Richardson, that the potion drunk by Juliet was the ancient preparation of mandragora, and Shakespeare repeatedly alludes to its powers. Thus, Iago, musing upon the distraught Othello, exclaims:

"Not poppy, nor mandragora,
Nor all the drowsy syrups of the world,
Shall ever medicine thee to that sweet sleep
Which thou ow'dst yesterday."

and Cleopatra cries to Charmain,

"Give me to drink mandragora. . .
. . . That I may sleep out this great gap of time
My Antony is away."

A preparation of wine of mandragora, known as Morion, or death wine, is said to have been given in ancient times to those subjected to torture or to prolonged or painful death. According to a Jewish tradition, mentioned by Richardson, at the time when death by crucifixion was one of the Roman punishments, it was the custom of the women of the Grand Sanhedrim, to visit the prisoners upon the cross and to administer to them a sponge charged with Morion. The sufferings allayed by the drug (or at times possibly by syncope) the victim passed into a death-like sleep. After removal from the cross recovery took place so frequently that the Roman soldiers were commanded to mutilate the bodies of all the crucified before permitting them to be removed by friends for burial.

Dioscorides and Pliny give precise directions for the preparation of a solution of mandragora. Of a decoction of mandrake root, boiled down in wine to one-third of its former volume, Dioscorides directs that one-third of a cupful is to be taken when one suffers pain, and remarks that, "Physicians also employ this remedy when a necessity arises for amputation, or the employment of the actual cautery."

Reference is also made by Dioscorides to the usefulness of the remedy in promoting parturition, and Silvester referring to the book of Genesis, suggests that when Reuben brought mandrake to Leah, Rachel's strenuous endeavor to obtain the drug was for the purpose of enabling her to escape the pains of her approaching confinement. This is of especial interest in the light of recent experiences in the use of scopolamin-morphin anesthesia during parturition.

Apuleius says, "If one is to have a limb mutilated, burnt or sawn, he may drink one-half ounce (of mandrake) with wine, and whilst he sleeps the member may be cut off without pain or sense."

Pauleus Aeginetus refers to the heavy sleep and stupor produced.

and Hippocrates advises that it be given in tetanus in doses not sufficient to cause delirium. The ancient Persian writings are nearly barren of references to anesthetics, yet it is said that in the Persian work *Ihliyant Bade*, the statement occurs that the taking of atropa mandragora inwardly, renders one insensible to the pain of even cutting off a limb.

In 1869 Richardson secured specimens of mandrake root and imitated the ancient preparations of mandragora. Experimenting upon various animals and men, Richardson was able to partially confirm the claims made for this drug by the ancients, and as a result of his experiments he advocated that the drug be tried as a local and general anesthetic. No attention seems to have been given to this suggestion. Other members of the belladonna family have also been used to produce anesthesia. The thoughtful thug of India frees his victim from mental distress during his depredations by the administration of Daturia, and centuries ago a Japanese author writes, "When medicines are ineffectual, as well as acupuncture and the cautery, the abdomen and back may be opened and the stomach and intestines washed." On such occasions narcotic preparations containing daturia, aconitum and other drugs were to be used.

In the surgery of Theodoric, an Italian work of the thirteenth century, it is recommended that the *Spongia sommifera* be placed over the nostrils of a patient about to have an operation. This consisted of a sponge saturated with a mixture containing opium, mulberry, hyoscyamus, hemlock, mandrake, lettuce seeds and other drugs. As careful directions record that the patient is to be firmly bound, it is evident that the method was not expected to produce complete anesthesia, nor is it likely at ordinary temperatures, that the vapor arising from such a sponge would alone be strongly anesthetic.

The celebrated Chinese physician, Hoa-Thoa, who lived during the early part of the third century, gave to patients a preparation of hemp and at the end of some time it is said the patients became as "insensible as if he had been drunk or deprived of life." "Then according to the case, he made openings and incisions, performed amputations and removed the cause of the mischief without the slightest pain during the operation."

These references to ancient anesthetics show in a striking way that in the method of Schneiderlin we have a return to the most ancient form of anesthesia of which history bears record. Moreover the results now being obtained by solanaceæ and narcotic alkaloids

indicate that the ancients had a remarkably effective method of anesthesia which became one of the lost arts during the middle ages, finally to be reestablished with a more scientific, although, perhaps, no more effective techinque, after a lapse of seven centuries.

Scopolamin, $C_{17}H_{21}NO_4$, was first isolated from Scopolan Japonica, Schmidt, in 1890. It occurs in most of the solanaceous plants, including hyoscyamus, duboisia and belladonna. It deteriorates when exposed to light and air and is difficult to isolate in a pure state. It is allied to, or identical with, hyoscin. Physiologically it decreases the excitability of the cerebral cortex, paralyzes the peripheral sensory nerves, depresses the pneumogastrics, stimulates the vasomotor system in small doses, and decreases the blood pressure in large doses, checks the secretion of saliva and perspiration; but may slightly increase the flow of urine. It is rapidly eliminated and the effect upon respiration exceeds that upon the circulation. Dogs recover after enormous doses of the drug, and after toxic doses of mandragora Richardson found that the heart continued to beat for some time after the respiration had ceased.

The lethal dose in man is undeterminable. One-onehundredth grain of hyoscin has been given hourly for days without appreciable injurious effect. Recovery has followed the ingestion of $\frac{1}{4}$ grain of scopolamin, and the fatalities reputed to be due to scopolamin-morphin injections are for the most part clearly due to other conditions. As the method has been used in cases in which chloroform and ether were contraindicated, and in which the patients were in grave danger from the advanced pathologic conditions present, it is not strange that deaths have been recorded as occurring in from a few hours to days after the operation. In no case has it been proved that the scopolamin was the direct cause of the fatal issue, and one who has noted the rapid elimination of scopolamin hesitates to credit the fatalities as due to the use of the drug.

The majority of the patients anesthetized by this method require chloroform or ether in addition. Israel found that only nine and six-tenths percent. of patients were sufficiently anesthetized by the narcotics alone. Bloch, using a much larger dosage, succeeded in anesthetizing twenty-five percent., and Terrier twenty-six percent. Yet for celiotomies Terrier advises that inhalation anesthesia be always used, 1-64 grain of scopolamin being given two hours before the administration of chloroform. While it is thus admitted that ether or chloroform are required in the majority of cases, it is pointed out that

one-fifth of the usual amount of chloroform is required to produce anesthesia. Seelig suggests that 1-100 grain of scopolamin, and ¼ grain morphin be given one-half an hour before the anesthetic, and advises the drugs merely as adjuvants, enabling one to greatly reduce the amount and likewise the untoward effects of chloroform or ether. It is evident that in cases in which chloroform or ether are used, the chloroform or ether must be administered with great care to the already partially narcotized patient, and it is likely that the giving of these anesthetics in the usual dosage may be sufficient to cause death. We are not convinced that the routine use of scopolamin as an adjunct to general anesthesia will be more popular than that of atropin-morphin. We have observed the patient apparently asleep from scopolamin-morphin develops a violent scopolamin delirium as soon as the attempt was made to administer ether, while the same patient would have quietly submitted to the anesthetic if she had not previously received the scopolamin. It must be admitted, however that the delirium may have been no more active than would have occurred during the second stage of ether anesthesia, and also that the majority of patients may be quietly anesthetized after having been given scopolamin-morphin. In our experience, however, nearly all our patients are conscious and show little blunting of the faculties half an hour after the administration of ¼ grain of morphin with 1-100 grain of scopolamin.

The present work has been carried out in the endeavor to evolve a method which would enable inhalation anesthesia to be dispensed with nearly in every case. Ten years ago we observed that patients with acute alcoholic delirium could at times be thrown into a coma and rendered almost insensible to small surgical procedures by hypodermic injections of 1-10 grain of apomorphin hydrochlorate. This observation prompted us to incorporate a minute dose of apomorphin in the method of producing anesthesia, and the drug proved to be markedly efficient in overcoming the tendency to delirium and in diminishing the reflexes. Moreover, we were able to reduce the time required for the production of anesthesia.

To more precisely estimate the possibilities of the method, no anesthetic was given by inhalation in the surgical service of the Samaritan Hospital for nearly a month. All patients requiring operation, with the exception of infants, were anesthetized by one of the solanaceous alkaloids in combination with morphin and apomorphin. As it was found that patients began to come out of the anesthesia at the end of two and one-half or three hours, the undesirability of giving

the first hypodermic four hours or even two and one-half hours before the operation, was apparent, for in this time the patient, as a rule, has passed through the maximum effect of the first injection and is rapidly resuming a normal condition. The injections were, therefore, given from fifteen to twenty minutes apart, the dosage being regulated by the condition and reaction of the patient. In this way it is found possible to anesthetize the more susceptible patients in forty-five minutes or an hour, a time sufficiently short as not to interfere in the majority of emergency operations.

Scopolamin, duboisin, daturia, hyoscin, atropin, homatropin, morphin, narcein, apocodein, dionin, codein, and apomorphin were used, but satisfactory results were obtained only from scopolamin, hyoscin or duboisin combined with morphin and apomorphin.

Scopolamin or related alkaloids were used for purposes of surgical anesthesia in forty cases. In thirty-five cases no anesthesia was given by inhalation, while in five, ether was administered. Three of the latter and two of the former were in children. The operations performed without inhalation anesthesia, include craniectomy, laryngorrhaphy, tracheotomy, gastro-enterostomy, partial cholecystectomy, appendectomy, hysteromyomectomy, salpingectomy, operation for fistula in ano and hemorrhoids and plastic operations and small amputations of the extremities. Of the thirty-two adults who received anesthetics by inhalation, about 70 percent. were satisfactorily anesthetized while about 30 percent. struggled more or less violently and required firm restraint.

Technique.—The patient is prepared as for an ordinary anesthetization by means of baths. laxatives and enemas. Sixty minutes before the time of operation the patient receives hypodermic No. 1: Scopolamin hydrobromid, 1-100 grain; morphin hydrochlorate, $\frac{1}{6}$ grain.

From this the patient usually becomes somewhat sleepy, but remains conscious. An enema is now slowly run into the bowel, by gravity from an elevation not greater than two feet above the bed, consisting of spiritus etheris compositus, $\frac{1}{2}$ ounce; spiritus frumenti, $\frac{1}{2}$ ounce; warm water to make four ounces. Fifteen minutes after hypodermic No. 1, hypodermic No. 2 is given: Scopolamin hydrobromid, 1-100 grain; morphin hydroclorate, $\frac{1}{6}$ grain. Following this the patient's drowsiness increases and some reduction in sensibility may be noticed, but the patient remains conscious.

Fifteen minutes after the second hypodermic, the patient may be moved to the operating room with the confidence that in many cases

complete unconsciousness with anesthesia can be induced in from three to ten minutes hy hypodermic No. 3: Apomorphin hydrochlorate, 1-30 to 1-10 grain; scopolamin hydrobromid, 1-100 grain.

This often is not followed by vomiting. Frequently there will be a slight effort at emesis with the ejection of a small quantity of mucus; but the patient is found to be unconscious during or immediately after this effort, and thereafter vomiting does not occur. Should the patient prove refractory to hypodermic No. 3, and anesthesia not be produced, hypodermic No. 4 may be given after an interval of fifteen minutes. Or if the operation be a prolonged one, and if during its course the patient shows a tendency to move about, hypodermic No. 4 may be administered. This consists of morphin hydrochlorate, 1-30 grain; scopolamin hydrobromid, 1-100 grain.

The dose of apomorphin is to be regulated by the condition of the patient, and is to be used sparingly or avoided when the pulse is weak.

MODIFICATIONS.—In persons habituated to narcotics, the dose of morphin and apomorphin may have to be cautiously increased or repeated. Not more than 1-10 grain apomorphin should be administered at a dose, nor more than 1-15 grain in the weak or debilitated. In operations about the bowel, in lieu of the enema, the following draught may be given: Spiritus etheris compositus, 3 drams; spiritus frumenti, 3 drams; water, 2 ounces.

The effects of the third hypodermic are produced in from five to ten minutes. One patient, three minutes after the third injection, placed his hand over his mouth, apparently nauseated, but immediately became unconscious and nephrotomy was performed without any struggling by the patient. The results in all cases have not been satisfactory. Of thirty-two adult patients, three (9.4 percent.) were absolutely quiet during the operation, and showed only a slight reflex muscular rigidity. Nineteen (59 percent.) showed muscular reflexes but were quiet, and the progress of the operation was not interfered with. Five showed active reflexes upon the operating table requiring forcible restraint but not greatly interfering with the operation, and five patients, including two children under ten years of age, were so violently active as to interfere with the operative manipulations. In every case, including the patients who violently resisted the knife, complete unconsciousness was present, and on awakening the patients had no recollection of an operation having been done and in some instances did not even believe that they had been put to sleep. In a few patients there was a moderate postoperative delirium, resembling

that seen after the administration of hyoscin. This was especially noted in children, in whom the delirifacient action of the scopolamin predominated, and was also noticed in a patient who had been addicted to morphin, and in whom, therefore, the counteracting influence of the morphin was largely lost. In two of the patients capillary oozing persisted during the operation, but in both cases operations were performed in recent scar tissue. In no case was there a tendency to post-operative hemorrhage. With the exception of one case in which, after operation by one of the surgical assistants, infection of the wound occurred, the healing was prompt and satisfactory. Three patients died. One from shock and hemorrhage following a railway-crush of both thighs, a second from meningitis following fracture of base of skull with laceration of meningeal arteries, a third with hydatiform uterine mole, nephritis and hepatitis suddenly collapsed with abdominal symptoms, and the anesthesia of operation gave but temporary respite to her desperate condition.

The conclusions reached regarding scopolamin-morphin anesthesia are as follows:

(1) That the method is a rehabilitation of the most ancient known method of anesthesia.

(2) That the danger point of the operation recedes as the operation progresses, so that usually in prolonged operations, the pulse and general condition are better at the finish than at the beginning, while conversely the prolonged inhalation of ether or chloroform is associated with progressively increasing changes in the parenchymatous organs and increasing shock.

(3) That the avoidance of preliminary excitement, the absence of vomiting in most cases, the preservation of the pharyngeal reflexes, the quiet respiration, and dryness of the skin, throat and upper respiratory passages, and the continuance of analgesia for many hours after the operation, with the absence of malaise or lethergy, so often succeeding inhalation anesthesia, are frequently of great advantage. It is the best method of anesthesia in operation involving the upper respiratory tract.

(4) The element of danger is probably more to be attributed to the morphin element than to the scopolamin, and there is reason to believe that the danger from ether or chloroform anesthesia is distinctly increased by the previous use of these narcotics.

(5) That Duboisin and other members of the atropin series may be used instead of scopolamin.

(6) That the time for the production of the narcosis should be as brief as is consistent with safe dosage, as the duration of the scopolamin effect, in many patients, does not exceed two or three hours.

(7) That apomorphin is a powerful adjuvant, increasing the relaxation and the depth of the narcosis.

(8) That as at present used, the method is not well adapted to children and to certain others who are especially susceptible to the delirifacient action of the scopolamin. In persons of this type, a brief, but undesirable period of delirium may also follow the use of the anesthetic and mar the desired postoperative calm.

(9) That while in susceptible patients the method possesses great advantages, in a considerable percentage increased reflexes, delirium and other conditions are found necessitating, at an added risk, the use of a general anesthetic. The method, therefore, possesses the great disadvantage of uncertainty.

(10) That further investigation, and improvements to increase the certainty and safety of the method, and greater pharmaceutic accuracy in the isolation and standardization of the drugs used are much to be desired. In this way only would it seem to be possible to evolve a method sufficiently reliable to come into general use.

Notes on Anesthetics, with Special Reference to Scopolamin-Morphin Anesthesia.

BY A. C. WOOD, M. D.

[Read October 25.]

A satisfactory anesthetic should meet the following requirements: First, it must be safe. No drug could be considered for a moment if its use subjected the patient to a greater danger than the condition for which it was administered. Second, it should cause complete anesthesia. Third, it should be as free as possible from unpleasant effects.

Without discussing details, it may be asserted that no substance known at present meets all of these conditions, nor is it probable that one will ever be discovered. It may be accepted as a fact that the anesthetic state, however caused, always borders on the danger line, and its induction requires the closest attention and the employment of every known safeguard.

In considering the relative safety of an anesthetic we must take into account not only the immediate effects, but also the remote results. The former are, I believe, fully appreciated. The latter, I fear, are seldom suspected. Doubtless, many more deaths following operations are due to the late results of the narcotic employed than are surmised.

We know that ether is unsafe in certain pulmonary and bronchial affections, and that pneumonia sometimes follows its administration. Chloroform is generally considered a dangerous anesthetic, and is avoided as much as possible. Both ether and chloroform act as irritants on the kidneys, and both are dangerous in proportion to the length of time and the amount administered.

Recent researches show that aciduria, acid intoxica and fatty degeneration of internal organs may result from the inhalation of chloroform, and possibly also, in rare cases, of ether.

Enough has been said, I think, to indicate the desirability of adding to our present resources for the production of surgical anesthesia. The most recent suggestion for this purpose is the use of scopolamin. This drug is official in the last Pharmacopeia under the name of Scopolaminæ hydrobromidum, and is defined as "the hydrobromid of an alkaloid obtained from plants of the Solanaceæ; chemically identical with hyoscin hydrobromid."

Scopolamin was discovered by Schmidt, of Marburg, in 1890, in scopola, a plant named after Scopoli, an Austrian naturalist.

In the last edition of his therapeutics, H. C. Wood states that the dominant physiologic action of hyoscin is upon the cerebral cortex, producing sleep, often accompanied by a low, muttering delirium. It is also a centric depressant of respiration, and depresses, though somewhat feebly, the whole motor cord. Its influence upon the circulation is very slight. In cases of severe kidney disease it would seem to be a safer hypnotic than morphin, and as it has no sedative influence upon the heart, it may be used when the feeble condition of that viscus forbids chloral.

As a hypnotic, the alkaloid lends itself very well to combinations, intensifying greatly the influence of morphin, chloral, trional, and other drugs of this class.

The dose is given as $^1/_{150}$ to $^1/_{80}$ grain. Although $^1/_{50}$ grain is said to have caused alarming symptoms.

In the event of an overdose of scopolamin, the proper remedies would be the diffusable stimulants (Shoemaker).

It was first employed as a general anesthetic in surgery in 1900, by Schneiderlin, who had been using it as a hypnotic in the insane wards. He conceived the idea of combining it with morphin for operations on these patients, many of whom violently resisted the administration of chloroform and ether. The experiment seems to have been successful, but after a brief period the method was apparently discontinued, and was revived in Germany two years ago in surgical and obstetric practice. Its use was introduced into France last year; and it has since been placed on trial in this country.

Administration and Dose.—As an anesthetic in surgery, scopolamin is always combined with morphin, and reference to "scopolamin anesthesia" should be understood to mean this combination. Scopolamin hydrobromid appears to have been universally employed. Any of the salts of morphin may be used. The hydrobromid is preferred by some, but the sulphate seems to answer equally well. Both drugs are administered hypodermically, and they may be given in the same injection. It is desirable to have the solutions or tablets separate, however, in order that the dose of each may be varied to suit the case. If solutions are used, it is imperative that they be freshly made. This is one of the two essentials to success. Scopolamin solution should not be used after having been made more than from three to seven days. The second essential is a reliable preparation.

One or more injections are given, according to the views of the surgeon, and the requirements of the case. Some prefer to give a single moderate dose as an adjuvant to one of the usual forms of anesthesia, while others give larger doses in an effort to induce complete insensibility, without the aid of any other narcotic. Inasmuch as the susceptibility of different individuals to both of these substances varies greatly, it is unquestionably advisable to first give a moderate dose, and repeat it once or twice if necessary, as the circumstances warrant. In repeating the doses, it may be found that the proportions should be varied, if the constitutional effects of one drug or the other predominate to a marked degree.

Schneiderlin, who originated the method, gives the following technique: The patient is tested with a preliminary dose of $^{8}/_{10}$ mg. ($^{1}/_{80}$ grain) to 1 mg. ($^{1}/_{65}$ grain) scopolamin, and then 2 cg. ($^{1}/_{3}$ grain) of morphin, preferably on separate days. The susceptibility of the individual having been determined, he then administers an hour and a half before operation $^{8}/_{10}$ mg. ($^{1}/_{80}$ gr.) to 1¼ mg.

($^1/_{50}$ gr.) of scopolamin, and 2 mg. ($^1/_3$ gr.) to 3 cg. (½ gr.) morphin. If, fifteen minutes before operation, the narcosis is not sufficiently profound, an additional dose, $^2/_{10}$ mg. ($^1/_{325}$ gr.) to $^4/_{10}$ mg. ($^1/_{160}$ gr.) of the former and ½ cg. ($^1/_{12}$ gr.) to 1 cg. ($^1/_6$ gr.) of the latter is given. In emergency work it is necessary to proceed at once, without the preliminary test.

While I have seen no unfavorable symptoms result from the use of scopolamin, I am at present inclined to give smaller doses, *e. g.*, $^1/_{100}$ grain with $^1/_6$ grain of morphin to an adult, and repeat them, if needed, rather than to use one large dose.

Advantages.—Among these are the tranquil state of the patient; the absence of anxiety or fright; the entire freedom of mucus from the air passages; the absence of vomiting; it may be given upon a full stomach; the patient sleeps for some time after the operation, awaking as from a natural sleep, except that there may be some confusion of ideas; the pain and discomfort for some hours after operation are less than after ether and chloroform; and food may be taken as soon as desired. It is said to raise the blood pressure, and hence to diminish the tendency to shock. In successful cases the anesthetizer may be dispensed with. The contrast between the calm and quiet condition of the patient narcotized with scopolamin, and the restlessness, struggling, retching and vomiting observed when ether is unskilfully administered, is decidedly favorable to the former. Korff says it is free from danger to the heart or lungs, while no disturbances on the part of the kidneys, liver or digestive tract have been observed. It may be employed in conjunction with either local or general anesthetics, and this, I believe, will be its most important function. When used in addition to ether or chloroform, the perfect relaxation of the patient, and the absence of vomiting and respiratory troubles, make this combination especially satisfactory. In military and naval practice the small bulk and portability of the drugs constitute a strong recommendation.

Disadvantages.—As one or two hours, or even more, must elapse after the administration of the scopolamin before the anesthesia is complete, this method is not available in emergency work, if it is intended to displace ether entirely. When the narcosis is profound, unconsciousnes may last several hours, during which time it is absolutely impossible to awaken the patient. All persons are not equally susceptible to the drug, and hence it entirely fails in some cases. As

a matter of fact, I believe the real trouble is not a question of the susceptibility of the individual as much as that of securing a uniform and reliable preparation. Everyone who has employed hyoscin frequently must have been impressed with the uncertainty of its action, which can be explained only upon the theory of variation in different samples of the drug. Further, some experience is required to so adjust the doses of the two substances to the particular individual that the narcosis shall be both safe and complete. Some patients are excited and restless under its influence. The respiration must be watched during the period of narcosis. It is unsafe to leave the patient unattended during this time.

Indications.—The use of the scopolamin-morphin mixture to produce surgical anesthesia is of such recent origin that its true value remains to be determined. In general, it may be said that in the absence of contraindications, it may be given in any case in which it is desired to produce insensibility to pain, but in which absolute muscular relaxation and quiet during the operation are not necessary. If complete relaxation is required at any stage, a few inhalations of either chloroform or ether will secure this result.

Its special usefulness appears to be as an adjuvant to ether or chloroform, and in those cases in which these anesthetics are contraindicated: namely, cachexia, arteriosclerosis, nephritis, fatty heart or other myocardial change, anemia, diabetes, etc., in advanced age, and in all long operations in order to reduce the quantity of ether required.

Contraindications.—According to H. C. Wood, hyoscin is strongly contraindicated in cases of acute disease of the throat interfering with respiration or deglutition. Therefore, it should not be employed in cases of tonsillitis, angina, laryngitis and similar conditions.

This form of narcosis is not suitable for operations involving the mouth or air passages. On account of the prolonged unconsciousness, the patient would require careful watching for several hours to insure against choking from the collection of blood.

Theoretically, it would be very dangerous in cases in which there is a tendency to edema of the lungs. All anesthetics are to be avoided if at all possible in such conditions, but especially those that reduce the force and frequency of the respirations, such as scopolamin and morphin.

As the narcosis lasts five or six hours, it is not appropriate for

slight cases, or for those who are so placed that they cannot be watched during this period.

The administration of scopolamin and morphin before ether or chloroform anesthesia relieves the patient of the fear usually felt, and diminishes, or even abolishes, the period of excitement usually observed. It also favors muscular relaxation, and hastens the period of surgical narcosis. The patient remains in a deep sleep for several hours after the operation. Complete rest is therefore assured, and in most cases vomiting is avoided. This is a very important consideration in many conditions.

When giving ether or chloroform after this form of anesthesia it must be remembered that the pupil cannot be relied upon as a guide. It may be contracted by the morphin, dilated by the scopolamin or fixed between these two extremes.

My attention was first directed to the use of scopolamin as a general anesthetic by Dr. Henry Norris, who introduced it at the University Hospital. I have employed it in fifteen cases, brief notes of which follow:

1. Mrs. A., aged 55 years, suffering from carcinoma of the left breast, was kindly sent to me by Dr. John C. Hirst. She received $^1/_{64}$ grain scopolamin and $^1/_6$ grain morphin at 10 A. M., and the same amount at 11 A. M. She fell asleep after the first dose, and the second caused a deep sleep, from which she could not be easily aroused. Her respirations fell to 6 per minute for a short time. The pupils were contracted, and there was divergent strabismus. Operation, at 1.30 P. M., consisted of the complete removal of the breast, the sternal portion of the pectoralis major, and a clean dissection of the axilla. During the skin incision, she moved the corresponding arm and the lower extremities slightly, but remained absolutely quiet throughout the balance of the operation. She awoke 3¼ hours after operation, in a confused mental condition, from which she gradually recovered. Convalescence was perfect, the wound healing *per primam* throughout.

2. Mrs. B., aged 44 years, referred to me by Dr. David Mackey, of Louisville, for carcinoma of left breast, with distinct enlargement of the axillary glands. The same dose as in the preceding case was given at 10.30 A. M. and 12 noon. The face, in this case, was considerably flushed, and the respirations for a time were as low as 8 per minute. Operation at 1.30. Although the narcosis seemed profound, the patient moved enough to be troublesome, and a very small quantity of chloroform was administered. Reaction was perfect; consciousness was fully restored 3 hours after operation. She had no recollection of any of the incidents after the first injection. Primary union followed.

3. Grace H., aged 9 years, admitted to University Hospital for mastoid

suppuration. Scopolamin $^1/_{192}$ gr., morphin $^1/_{18}$ gr., at 9.30 A. M., and again at 11.15. After first injection, her face was flushed, and her pulse rose from 110 to 160, one-half hour after injection; it dropped to 140, and rose again after second injection to 152, but soon came down to 132; respirations 16. She was drowsy, but restless. At 1 P. M., $^1/_{192}$ scopolamin alone was given. No effect could be noted from this dose. Operation 1.30. During the operation she required restraint, and even screamed whenever the knife or curette was used, and yet I felt sure from her actions that she was not really conscious of any pain. The narcosis lasted 4 hours. The most careful questioning after operation proved that she had no appreciation of any part of the operation.

4. John W., aged 39 years, necrosis of tibia. University Hospital. One-sixty-fourth grain scopolamin and $^1/_6$ grain morphin were given at 10, 11, 12 and 1 o'clock, without any apparent effect. Operation at 1.30. Nitrous-oxide-ether anesthesia.

5. Patsie S., aged 28 years, reamputation of thigh. St. Timothy's Hospital. One-sixtieth scopolamin and $^1/_6$ grain morphin, at 10, 11 and 12 o'clock. Operation at 2 P. M. The patient was drowsy, but not at all anesthetic. Ether was given. The result in this case was negative.

6. Kate B., aged 33 years, St. Timothy's Hospital. The same doses as above were given, at 10, 11 and 12 o'clock. Amputation of the cervix uteri for hypertrophy, at 1.40 P. M. The patient was awake but apathetic, and responded indifferently to questions. The anesthesia was complete, however, no additional anesthetic being required throughout the operation. She slept 4 to 5 hours after operation; no vomiting; no pain was felt during the operation.

7. Mary L., aged 47 years; fracture of patella; St. Timothy's Hospital; received the same doses as the preceding case, at 8.30, 9.30 and 10.30 A. M. Operation 11.40 A. M. The incision was made and the fragments prepared for drilling without any additional anesthetic, although the patient moved frequently. As perfect quiet was desirable at that point, ether was administered. She had no recollection of the operation. Healing by primary union followed.

8. Charles P., aged 40 years; St. Timothy's Hospital. The same doses were given at 8.30, 9.30 and 10.30 A. M. Internal urethrotomy was performed at 12.30 P. M. He was so restless that it was necessary to administer chloroform. There was no recollection of pain.

9. Thomas R., aged 25 years; St. Timothy's Hospital. Received the above dose at 9 and 10 A. M. He was very somnolent, but awoke when moved. The abscess was opened and curetted. Although he moved slightly, he had no recollection of pain. He slept 12 hours after operation.

10. William G., colored, aged 94 years; Philadelphia Hospital; received $^1/_{96}$ grain scopolamin and ¼ grain morphin at 11 A. M. and 1 P. M. Suprapubic prostatectomy at 2 P. M. The patient was very somnolent and insensitive so that no additional anesthetic was required. The enlargement of the prostate was found to be due chiefly to two abscesses. The enucleation was difficult on account of the inflammatory exudation. The patient

remained dull after operation, and died the following day. It is a matter of doubt whether the anesthetic or the shock of the operation contributed to the fatal result. The large doses of morphin were given by mistake; but $^1/_6$ grain having been ordered.

11. James W., aged 74 years; Philadelphia Hospital; received $^1/_{60}$ grain scopolamin and $^1/_6$ grain morphin at 11, 12 and 1 o'clock. Suprapubic prostatectomy at 2 P. M. Patient somnolent, but the abdominal muscles were so rigid that it was necessary to give chloroform in small quantities. The enucleation of the prostate was accomplished only with the greatest difficulty; no proper capsule could be found. I felt justified in making a diagnosis of malignant disease from this condition. The convalescence was satisfactory. The microscopic diagnosis of the mass removed was scirrhus carcinoma.

12. Mrs. B., aged 37 years, was seen in consultation with Dr. J. S. Woodruff, during an acute attack of appendicitis. Operation was advised. She was admitted to a private room in St. Timothy's Hospital. Scopolamin anesthesia was used in this case at the suggestion of Dr. Woodruff, who kindly consented to superintend its administration. At 10.15 A. M., $^1/_{100}$ grain of scopolamin and ¼ grain of morphin were given, and at 11 a second dose of $^1/_{100}$ grain of scopolamin and $^1/_6$ grain of morphin. This was followed immediately by an enema, consisting of one ounce each of whiskey, compound spirits of ether and elixir valeriante of ammonia, in 6 ounces of water. The anesthesia was completed by an injection, at 11.30, of $^1/_{100}$ grain of scopolamin and $^1/_{15}$ grain of morphin. Upon my arrival at the hospital, at 11.45, the patient presented the appearance of a person in a deep sleep and was fully narcotized. She was transferred to the operating room, and the appendix was removed without giving any other anesthetic. The muscles were fully relaxed and the anesthesia perfect. The patient awoke 3½ hours after the operation, without any suspicion that it had been performed. There was no nausea or other untoward symptoms. No anesthetic could have been more satisfactory than the scopolamin-morphin was in this case. The convalescence was rapid and satisfactory in every way.

13. George S., aged 32 years, colored. Abdominal section for intestinal obstruction following operation for strangulated hernia. He was given 3 doses each of $^1/_{100}$ grain scopolamin and $^1/_6$ grain morphin, without apparent effect. Ether was therefore given for the operation. He took the anesthetic exceedingly well. There was no trouble of any kind during the entire operation. This is in marked contrast with our experience at the previous operation, when the ether was taken very badly. The patient stopped breathing, and artificial respiration had to be resorted to, and of course, all operative procedures suspended during efforts to restore respiration. Both the anesthetist and the surgeon were annoyed throughout the entire period of the operation by the unsatisfactory anesthesia. In the former case neither had the slightest trouble or apprehension from first to last. Although I have called this case a failure, so far as the narcotic effects of the scopolamin are concerned, it proved exceedingly useful apparently, in aiding in the ether anesthesia.

14. Mrs. L., aged 67 years, received $^1/_{100}$ grain scopolamin at 10.20 and 11 A. M. Amputation of toe at 11.15. The patient apparently felt the incision, and to assure myself on the point, I asked her if this was the case. Although she was a little dull, she answered "Yes" very positively. A little chloroform (40 minims) was given, and the operation completed. She slept 3 hours after the operation, when she became very much excited and noisy. These symptoms were controlled by 30 grains of bromid. Although a little chloroform was given in this case I consider it a successful example of scopolamin anesthesia because sensation was fully abolished after the operation was concluded. The drug had not been given at the proper time on account of an unavoidable occurrence.

15. Miss W., aged 30 years, cyst of the left breast. The patient received $^1/_{100}$ grain scopolamin and $^1/_6$ grain of morphin at 10.15, 10.40 and 11.10 A. M. Operation at 11.30. The patient was perfectly anesthetized, the cyst being removed without evidence of sensation on the part of the patient. Consciousness returned 3 hours after the operation.

Conclusions.—The result of my personal experience with scopolamin-morphin anesthesia and a brief study of the subject may be epitomized as follows:

(1) It is capable, in many cases, of producing a satisfactory surgical narcosis lasting several hours.

(2) When successful, the patient avoids the anxiety or even alarm often felt before taking ether, and the nausea, vomiting and depression following its administration.

(3) If it should partly or wholly fail to anesthetize the patient, the surgeon may use ether or chloroform with the assurance that the effect will be more prompt and satisfactory than when either is administered alone.

(4) When used in conjunction with ether or chloroform it has been especially satisfactory. The time required to induce anesthesia was lessened, relaxation promoted, the secretion of mucus in the respiratory tract prevented, and what is very important, the quantity of anesthetic required was greatly reduced.

(5) To induce full anesthesia in the average healthy adult, I recommend $^1/_{100}$ grain (0.0008 gm.) scopolamin and $^1/_6$ grain (0.01 gm.) morphin, to be given hypodermically 2 or 2½ hours before operation, and a second similar dose an hour later. If the anesthesia is not sufficiently complete, half an hour before operation, a third dose may be given. This may be the same as the two previous doses, or may consist of either drug alone, or of scopolamin in conjunction with apomorphin, according to the special indications present.

The doses should be considerably reduced in children, feeble patients and in advanced age.

(6) None of my patients remembered feeling any pain, or any other detail of the operation, although in some instances they gave evidence of suffering at the time.

(7) Its use is contraindicated in acute affections of the pharynx and larynx; operations involving the mouth or air passages; edema of the lungs; and in cases in which capillary hemorrhage may be a troublesome factor.

(8) A few deaths have been ascribed to this anesthetic, whether justly or not I do not know. However, as both scopolamin and morphin are powerful drugs, prudence demands that they be used with caution.

(9) In addition to the caution mentioned, the safety and success of the method depend upon having pure and reliable drugs and perfectly fresh solutions.

DISCUSSION.

DR. WILLIAM L. RODMAN: My personal experience with this anesthetic is limited to one case, but that one case enables me to confirm everything that has been said by the two speakers. While the anesthesia was not complete, still it was made so by an ounce of ether given after 2 doses of the drug given hypodermically and the operation was done without pain, excitement or any unpleasant sequelæ. I shall be disposed to use the drug more freely, but it is very evident that we can only employ it as an adjuvant to ether and chloroform. It fails so often that it cannot be regarded as an entirely satisfactory agent. It is valuable, however, for there are times when ether and chloroform are contraindicated. Scopolamin has a practical value in operations on the genitourinary tract. I think we are all remiss in not availing ourselves of undoubtedly the safest and the best form of anesthesia—preceding ether by nitrous oxid.

DR. JOHN B. ROBERTS: If scopolamin is the same as hyoscin, I am astonished at the small doses which are given. I cannot understand why 1-50 grain of hyoscin, which I have frequently given 2 or 3 times during 24 hours, may not be given with safety in this method of anesthesia. Hyoscin in small doses excites patients. In larger doses it puts them to sleep. My routine prescription after serious surgical operations, is hyoscin hydrobromid 1-50 grain, codein sulphate 1½ grains, given hypodermically. This is repeated if necessary, because of restlessness or pain, once or twice during the first 24 or 36 hours. This is my practice in abdominal as well as general surgery. I thus prevent my patients suffering the tortures of the "damned," during the first night after abdominal sections. Water to drink and hyoscin and codein to produce sleep, after operation, will harmlessly relieve the horror of many operative procedures. I have no experience in general anesthesia with hyoscin.

DR. ERNEST LAPLACE: I have used scopolamin-morphin anesthesia in 2

cases and the effects were encouraging, but I did not go so far as has been described here to-night. I must say, however, that the administration of ether as a concomitant left the patient with very few of the subsequent symptoms that are so common after ether administration. There was no vomiting and practically none of the after effects of ether. However, I was discouraged in the further use of it by my observations in Paris.

DR. ALICE M. SEABROOKE: We have used this anesthetic in the Woman's Hospital in 3 cases. One was a case of carcinoma of the omentum upon which Dr. Rodman operated 3 years ago for ventral hernia. He could not use general anesthesia and employed cocain, with pencilling of carbolic acid along the line of the incision. This year the woman returned to the hospital and we operated under scopolamin with success. It was rather startling in the middle of the operation, when some 18 inches of intestine were out on the abdominal wall, to have her ask for a glass of water. No ill effects followed the operation. In 2 other cases, one a hysterical child of 12 with appendicitis, and the other an aged woman with gall stone, neither able to have a general anesthetic, there were no ill effects. We found in one of these cases that there was not complete relaxation of the abdominal muscles.

DR. H. C. WOOD, JR.: It seems to me that a better name for this method would be morphin anesthesia. The important question concerning a new anesthetic is that of comparative safety. The number of reported cases of morphin-hyoscin anesthesia is so small that we can draw no absolute deductions. When we remember that the mortality in ether anesthesia is placed at 1-15,000 the 1,000 or 2,000 cases of the newer method become evidently insufficient from which to form any positive deductions as to safety. I would call attention to two facts: (1) That morphin has been used for many years as an adjuvant preceding the administration of ether and that it has been thoroughly demonstrated that it lessens many of the unpleasant sensations produced by ether; but I think it is also pretty well demonstrated that it increases the danger of respiratory failure from ether. (2) That while morphin is an analgesic is also depresses respiration, and the mortality in these cases has been greater than when ether has been used alone. Atropin has also been used before ether with beneficial results. I agree with Dr. Rodman, that nitrous oxid gas is a much better drug than morphin with which to precede ether.

DR. BABCOCK: In reference to the objection made by Dr. Wood to this method of anesthesia for operations about the throat and mouth, I should like to say that our experience has indicated that it is especially valuable in such cases. In one of our first cases, an old "cut-throat," the larynx had been completely divided, the esophagus had fallen between the cut ends and was adherent to the skin. Not realizing the proximity to the esophagus, I divided the old cicatrix and entered the esophagus, but the repeated efforts at swallowing by the patient revealed the true situation. In a second case in which a considerable portion of the lip was removed for carcinoma, the blood which passed into the mouth was quietly swallowed. In a third case a portion of the mucous lining of the lip was dissected out, and the blood which passed into the mouth produced no coughing or irritation during or after the operation. After these 3 cases we became convinced that if the method was valuable in operations in any region it was particularly in operations that involved the upper respiratory tract, and

we believe that it offers a means of reducing the mortality in such operations, as laryngectomy and laryngotomy.

DR. WOOD: In regard to calling this morphin anesthesia, I think that matter has been fully studied and the conclusion has been reached that there is legitimate ground for speaking of it as scopolamin or better still, as scopolamin-morphin anesthesia. I realize that the morphin is an important part of the method, because scopolamin would, in many cases, produce so much excitation that it would be impossible to operate. I have seen enough morphin given to know that the effect of scopolamin and morphin is different from that of morphin alone. It is true that the number of cases before us is too small to make any deductions; at the same time, as stated in my paper, Dr. H. C. Wood says, in his Therapeutics, that no fatal case of hyoscin poisoning is on record. If that is so, we need not feel very much alarmed about the mortality. I always approach a new method very cautiously, and while I agree with Dr. Roberts that hyoscin may be given in the dose he mentions, without the least fear of doing harm, still I feel that I should give only as much as is necessary. If the method is of value and I continue its use I may get much bolder later on. Some patients are so much more profoundly influenced than others that the dose is difficult to determine. Some patients get very delirious and hence to start with a large dose makes them troublesome. I have seen some patients absolutely anesthetic on two doses of 1-100 grain scopolamin and $\frac{1}{8}$ grain morphin each.

SYMPOSIUM ON NEURASTHENIA.

[November 8.]

The Morbid Physiology of Neurasthenia.

BY WILLIAM PICKETT, M. D.

While the Greek root *sthen* means "strong," it implies, classically to an extent, and in the acquired medical sense even more, *dynamic* strength; and asthenia means, for us, want of force, of endurance—in one word, exhaustibility. A simple instance of this use is in *myasthenia,* exhaustibility of muscles. In myasthenia gravis the muscles may be fairly strong, but they lose their force rapidly. They are spent by a brief effort, and actually paralyzed with fatigue. Myasthenia gravis is localized ordinarily to muscles of the eyes, face, throat, etc., supplied by bulbar nerves. As it is parallel thus to organic bulbar palsy it has been regarded as a bulbar asthenia, and was named by Strümpell "asthenic bulbar paralysis." Even when wider spread it is explained as a recurrent paresis of motor nerves.

Another simple illustration is the muscular unendurance of the eye—asthenopia. The ophthalmologists apply this term to conditions in which the refraction and the accommodation may be normal—the

emmetropic eye, yet the muscles quickly tire, so that accommodation fails, and in reading the letters jumble, etc. Here we cannot, as in myasthenia gravis, think of a definite seat in the nervous system. The ciliary muscle is supplied by the third nerve, but from only a fraction of its nucleus; so this op-asthenia—asthenopia—is not parallel to ophthalmoplegia, as myasthenia gravis is to bulbar palsy. It seems simply a ready fatigue of the ciliary muscle and perhaps of the internal recti.

Moreover, asthenopia is generally in company with ready exhaustibility of various other organs—the heart, the stomach, the skeletal muscles: it is part of a general exhaustibility. In a patient physically normal, by all our methods of examination, this general exhaustibility must be ascribed to the general nervous system; and so we call it neurasthenia.

Not only is there in neurasthenia ready exhaustibility of all organs and functions, but in the confirmed case another character—want of recuperative power, leading to chronic exhaustion—the patient not only tires readily, but is tired always; he has, for example, not only atonic indigestion, but chronic gastric catarrh.

The exhaustion of neurasthenia is characterized also by "irritability"—the "irritable weakness" of older writers. A simple instance of this is the plus knee jerk usual in neurasthenia. In the organic nervous diseases increased reflexes show a diminished cerebral inhibition, a slackening of the check-reins from the cortex; and in this functional disease the *fatigue* of the cortex likewise liberates the spinal neurons, which thus overact and are overirritable.

Other signs of irritability in neurasthenia, the rapid pulse, the irregular pulse, frequent urination, etc., like the exaggerated reflexes, may be from overaction of lower centers liberated from the restraint of the cortex by its fatigue. In this light neurasthenia has been regarded as a functional brain disease; and, in view of the anxiety and depression in many cases, as a mental disease. But surely many symptoms of the disease are peripheral. The sensory irritability (neuralgic pains, etc.) is peripheral, by analogy with the pains of organic nervous disease.

We are all liable to exhaustion, our muscles and our various functions become weak from it—we have pains and aches from it. If we are sound this normal fatigue is largely peripheral. Our perceptions, it is true, may be dulled, the mental reactions to them slowed; but this, in mental physiology, mostly concerns lower levels. In the psychopathic individual, one with a bad nervous inheritance, the symptoms mount into the higher mental levels. Even normal

fatigue affects the higher psychic levels in a general way. The tired man wants decision in his business; the tired man has forebodings, he looks on the dark side of things and fears adversity; the tired man is irritable and impulsive, lacking the calm restraint of full nervous power. The fine edge of the mind is dulled by normal fatigue, to be "stropped" keen again by normal rest. In the psychopathic individual, hereditarily wanting in endurance, the fine edge of the mind becomes "notched" with obsessions—morbid fears specialized into the various phobias, indecision specialized into the *folie du doute,* want of self-control specialized into morbid impulses.

These special besetments—obsessions—are, in Regis' classification, neurasthenic insanities. They are the psychic manifestations of exhaustibility—*psychasthenia,* as it is now called, after Janet. Normal tire cannot storm the psychic citadel thus; this psychasthenia, marked by obsession (morbid fears, impulses, imperative ideas, and indecision) comes only in the neuropathic subject. It has been known to pass over into paranoia, that eminently neuropathic form of insanity, and Morselli regards it as undeveloped paranoia (paranoia rudimentale). Probably a commoner transition is into melancholia—the neurasthenic melancholia of recent German writers.

Surveying the field of neurasthenia, we find difficulty in fixing its boundaries. Without great care, we shall be including in neurasthenia cases of phthisis, of Bright's disease, of heart disease, of beginning febrile affections, of early tabes and paresis, or, as Dana recently emphasized, of various psychoses. As to the last, John B. Chapin declares that "neurasthenia is the soil out of which insanity develops"; while of the former debilitating bodily diseases it might be held that neurasthenia, if not the soil, is usually the atmosphere in which they flourish. In calling it the soil there is a fallacy like confounding the "typhoid state" with typhoid fever. We should recognize a true neurasthenia which is a simple fatigue-neurosis; then a neurasthenic state which is a symptomatic fatigue, found in most bodily organic diseases and, as a prodromal stage, in all mental diseases. For this last, Dercum's word neurasthenoid seems useful.

The chemistry of fatigue does not explain neurasthenia; nor is it likely that degeneration of cortical cell-bodies, alleged by van Gehuchten, is the fact in the ordinary case. The essence of the discase is fatigue and exhaustibility of the nervous matter. We can express it only by figures of speech, as the battery whose cells "run down," or as "expenditure" exceeding "income" and so draining the "capital."

The Diagnosis of Neurasthenia.

By F. X. DERCUM, M. D.

Whenever a patient complains of nervousness, no less than five possible conditions should be borne in mind. In the first place, we should think of the three great neuroses, that in neurasthenia, hysteria and hypochondria. Further we should bear in mind the various nervous states prodromal to the fully developed psychoses, such as the prodromal or developmental period of melancholia, of paranoia, of dementia præcox and the like. To these states which never present the symptom group of neurasthenia, I, several years ago, applied the term of the "neurasthenoid states." The symptoms which they present are never truly neurasthenic; they are simply like or grossly resemble neurasthenia and are, properly speaking, therefore, neurasthenoid. Finally we should bear in mind the nervous symptoms which accompany various visceral and general diseases, organic and functional. Here again the nervous symptoms are never those of true neurasthenia and there is present merely a neurasthenia symptomatica. Such a neurasthenia symptomatica is typically present in chlorosis and in other blood diseases. It is usually present in diseases of the various viscera and this fact makes it imperative that every case should be exhaustively studied from the standpoint of internal medicine. It is for this reason that the diagnosis of neurasthenia, so often merely means an imperfect diagnosis.

When we come to study neurasthenia in detail, we find that its symptoms are essentially those of chronic fatigue, of a fatigue which has become exaggerated and pathologic and it is for this reason that I many years ago applied to neurasthenia the term "the fatigue neurosis." This means something more and something slightly different from a neurosis of chronic exhaustion, for exhaustion, as I have already hinted at, may ensue from various diseases of the viscera, of the blood, of the organism as a whole, a toxemia or an infection as the case may be.

The symptoms of neurasthenia on the surface appear to be at first sight, hopelessly multiple and complex, but it soon becomes evident that they possess unequal value. They are readily classifiable as *sensory*, *motor*, *psychic* and *somatic*. As soon as we begin to analyze them in a systematic manner, we find that the sensory symptoms, to begin with, express themselves first in *generalized fatigue sensations*, that is, general sense of tire, general sense of weakness; second, as *localized fatigue sensations*, such symptoms as headache, backache and

limbache. When we turn our attention to the motor symptoms, we find present, in varying degree, muscular fatigue, muscular weakness and, above all, ready muscular exhaustion. When we turn our attention to the psychic symptoms, we find first and foremost a diminution in the capacity for sustained mental effort, ready mental exhaustion and diminution in the spontaneity of thought. When we turn our attention to the somatic symptoms, we note especially atony of the digestive tract, atony of the circulatory apparatus and disturbances of the secretions which can only be interpreted as signs of weakness and deficient innervation and finally disturbances of the sexual functions which can only be similarly interpreted. The above symptoms I have termed the primary or *essential* symptoms of neurasthenia; the other symptoms that make their appearance, I have termed the secondary or the adventitious symptoms. The essential symptoms are always those of chronic and persistent fatigue, while the adventitious symptoms are, as we shall see, its secondary outgrowths.

Sensory Symptoms.—The symptoms become more interesting when studied in detail. Beginning with the sensory phenomena, we have, to repeat, first vague fatigue sensations, generalized in character. The very first thing the patient tells us is that he is tired, that he is tired all of the time, that he feels like lying down; indeed that he is often compelled to abandon his work and to rest before he can again resume it. There is present a general sense of tire. This symptom, as I have just pointed out, is one of the essential symptoms. Not infrequently there are present associated or secondary symptoms direct outgrowths of the generalized fatigue. For instance, the patient not infrequently presents a feeling of uncertainty in regard to his movements or in regard to his environment; i. e., he sometimes complains of being giddy or dizzy without presenting any symptoms of real vertigo.

The localized achings are to be regarded as exaggerated fatigue sensations and are among the primary symptoms of neurasthenia. In early cases they disappear upon rest as do other fatigue sensations, though in cases of long standing, they may only be relieved and not disappear altogether upon the cessation of work. For instance, concerning headache, the average statement by the patient is that mental effort of any kind brings it on or if it be already present, makes it worse. The headache is diffuse in character and is usually most pronounced in the occipital region, though it may be frontal or widely diffused. Not infrequently we have associated with this headache,

sensations of pressure or constriction, more especially drawing sensations in the occiput and in the back of the neck; a sense of lightness or emptiness of the head or, on the other hand, of heaviness and fulness.

The backache is usually referred to the small of the back, sometimes to the midscapular region and at times to the sacrum. Not infrequently, however, secondary symptoms also making their appearance. Thus there may be present tenderness on pressure over the spine,—a tenderness which is, as a rule, most marked in one or more of the following regions: over the seventh cervical spine, over the middorsal region, over the dorsolumbar juncture, over the midlumbar region, over the sacrum or over the coccyx. These regions of tenderness constitute the symptoms which gave rise to the term "spinal irritation" employed by the physicians of a previous generation. Some times there is present in addition to these symptoms of spinal tenderness or "spinal irritation," also spontaneous pain or aching referred by the patient to the substance of the spine itself. Occasionally other areas or points of tenderness are noted in neurasthenia, such as tenderness of the teeth or gums and sometimes diffuse tenderness of the entire head (never the localized tenderness of the clavus of hysteria).

Not infrequently the aching in the limbs bears a direct relation to the occupation of the patient as for instance aching in the legs, in a collector, letter carrier or salesman, or aching in the arms in persons with occupations in which the arms are used excessively. In addition to the simple aching, other symptoms, secondary in value, are occasionally noted. For instance, subjective numbness, pricking, formication, velvety sensations or a subjective sense of heat or cold. The adventitious character of such symptoms is self-evident. It is to be especially noted that sensory loss, anesthesia, is never present.

When we turn our attention to the special senses, we find a similar interesting aggregation of symptoms, readily divisible into primary and secondary phenomena. As regards vision we have first and foremost the symptoms of ready fatigue. This fatigue is as a rule complex in its origin. Various elements, muscular, retinal and cortical or psychic play a role. Thus weakness and ready fatigue of the intrinsic and extrinsic muscles of the eye, weakness and irritability of the retina and ready cortical exhaustion play roles varying in degree in different cases. It is for this reason doubtless that mere correction of the eyes by glasses as a rule fails to relieve the eye symptoms of which the neurasthenic complains. The ready fatigue of the retina can be

demonstrated in various ways. Thus there may be a loss of power to perceive continuously a small object held at convenient focal distance from the eye. In addition to the symptoms of ready exhaustion, secondary symptoms are quite frequently present. Thus the patient will often state that everything seems "misty," that everything looks as though it were seen through a veil or he may complain that objects look dull or unusually bright to him. At times, too, irritability of the retina is so pronounced that the patient begins the use of smoked glasses of his own accord.

Disorders of hearing present the symptoms of localized fatigue less plainly than do the disorders of vision. However, neurasthenic patients will often say that they cannot "hear right," though this symptom when investigated, as a rule, proves to be psychic and not directly referable to the ear, that is, is due to lack of the power of sustained attention and not to any true difficulty of hearing. However, comparable to retinal hyperesthesia, we frequently have auditory hyperesthesia and this may be pronounced in degree. The patient may suffer exquisitely from noises, even when the latter are insignificant. Secondary auditory symptoms are also prominent. Especially is this true of tinnitus. A very large number of patients complain of ringing in the ears. At times such expressions as "roaring," "buzzing," "whistling," "beating," "throbbing" or "ticking" are employed by the patient. With regard to smell and taste, fatigue symptoms are not obvious. However, olfactory hyperesthesia is not an infrequent symptom of neurasthenia, the patient complaining inordinately of odors not noticed by healthy persons. Again, neurasthenic patients are notoriously peculiar in regard to their eating, often presenting extreme dislike of various wholesome articles of food. It is not impossible that these dislikes are in part at least owing to modifications of the sense of taste, similar to those presented by the other special senses.

Motor Symptoms.—When we turn our attention to the motor symptoms in detail, we find, as already stated, as the primary symptom, ready exhaustion. The sense of weakness is, as a rule, referred to the legs and small of the back. There is, however, never any local weakness, nothing in the faintest degree suggesting a paresis or paralysis. Among the secondary motor symptoms we note especially tremor. This tremor is an intention tremor and is usually fine in quality. There may also be noted at times slight spasms or twitchings in small muscular bundles here and there; for instance, in a few

fibers of the frontalis of the one side or perhaps of one or both orbiculares oculi. Less frequently similar twitchings are noticed in other facial muscles. These twitchings or slight spasms are rarely persistent and form a very unimportant part of the symptom complex. Occasionally entire muscles or muscle groups are affected by cramp or spasm. Such cramps are not infrequently observed by the neurasthenic in the calf muscles when he retires at night. They are, of course, to be regarded as indirect outgrowths of the fatigue.

The tendon reactions of the neurasthenic may be normal. More frequently, however, they present the symptom of irritability and we find, therefore, that in the majority of cases the knee jerks are decidedly increased. Now and then, however, due doubtless to lowered muscular tone, the knee jerks are diminished. They can, however, always be well reenforced. Occasionally also an ankle clonus is noted. It is, however, never so marked nor so prolonged as we find it in organic disease. It is most frequently faint and disappearing.

PSYCHIC SYMPTOMS.—When we turn our attention to the psychic disturbances, we find again as the most striking symptom a diminished capacity for sustained effort. Just as the patient is incapable of long continued physical effort, so is he incapable of long continued mental effort. The attempt to do brain work sooner or later brings on symptoms of exhaustion. The patient finds it more and more difficult to sustain his attention and at last fails altogether to do so. This, which is the essential and intrinsic psychic symptom of neurasthenia, often alarms the patient very greatly. He fears that he is about to lose his mind. Indeed, nothing is more common than to have the patient complaining of a "loss of memory." Notwithstanding he will usually give a most circumstantial history of his case, not omitting unimportant details and will otherwise show that there is no real loss of memory. The difficulty he has noticed is really due to lack of power of concentrating his attention for a sufficiently long period upon a given task. The idea of impending loss of mind is also suggested by the fact that ideas do not present themselves as readily as in health. There is a true lack of spontaneity in thought and this the patient makes known to the physician by the familiar expression that "he cannot think." Like the failure of the power for sustained attention, it is only another sign of fatigue.

The secondary psychic symptoms of neurasthenia are intensely interesting and would justify a much more elaborate consideration than is permitted by the present paper. We note, first, that the man

who is chronically tired, loses some of his personal force, aggressiveness and will-power. Second, coupled with this lack of will-power, hesitation, uncertainty, indecision, sooner or later make their appearance. Third, there is also a markedly increased irritability. That the tired man is cross is as well-known to the laity as to ourselves and this irritability is merely the expression of a more or less marked loss of self-control or inhibition. The chronically tired man is more readily angered or, on the other hand, is more readily brought to tears than is the man who is well. Fourth, should the opportunity arise, we would also note that the man who is chronically tired is also afraid; for weakness and fear inevitably go hand in hand. Indeed it is a well-known fact that neurasthenics are subject to spontaneous attacks of fear,—fear causeless in origin and generalized in character. Sometimes these attacks of fear are accompanied by pallor of the face and palpitation of the heart, just as is normal fear. More rarely they are accompanied by the most pronounced signs, the patient suffering from sudden weakness, pallor, coldness of the surface, excessive tachycardia and even relaxation of the sphincters. Such attacks are commonly mistaken for attacks of hysteria, but they bear no resemblance whatever to the latter affection. It should be added that occasionally the attack of fear is not accompanied by any physical symptom whatever. These interesting secondary symptoms may, in neuropathic subjects, give rise to the various so-called neurasthenic insanities; thus in a patient of pronounced neuropathic heredity—never in the normal individual—diminished will-power may give rise to *aboulia;* an impairment of decision to a true insanity of indecision, a *folie du doute;* a loss of inhibition may give rise to one or more of the various *obsessions,* the so-called insanities with *irresistible impulse;* and a generalized *fear* may give rise to one or more of the *special forms of fear* such as agoraphobia, claustrophobia and the like. It cannot be too strongly insisted upon that true and uncomplicated neurasthenia never terminates in mental disease. In a nonneuropathic subject, a neurasthenia will always remain a *neurasthenia simplex,* no matter how profound it may become. In order that the special symptoms I have just noted should arise, the patient must be essentially neuropathic, that is, have within himself the soil of mental disease. In neuropathic subjects mental fatigue is prone to develop just this class of symptoms; the symptoms each betray the essential characteristic of a degenerative psychosis, that is, fixation and the pathologic association of symptoms. For this special group of mental disturbances, the term neurasthenic

insanities is clearly a misnomer. I propose speaking of them myself in the future as the *neurasthenoid insanities.*

SOMATIC SYMPTOMS.—The somatic symptoms of neurasthenia, like the other symptoms thus far detailed, present as their essential characteristics ready exhaustion. Thus we have as the cardinal symptom of the indigestion of neurasthenia, atony, delay and enfeeblement. Nothing is more common than to have the neurasthenic patient complain of a sensation of weight and fulness after eating and of eructations of gas, a gas which is always tasteless. The disturbance of digestion may be intestinal as well as gastric or the patient may complain of abdominal distension, and constitpation is almost the rule. Secondary symptoms are of course present here as well as elsewhere.

The disturbances of the circulatory apparatus consist of modification of the force and rhythm of the heart's action, in the character and frequency of the pulse and in more or less marked alterations of vasomotor tonus. Perhaps the most striking, if not indeed the most common symptom of circulatory disturbances, is palpitation of the heart. While frequently associated with digestive disturbances, it is by no means dependent upon the latter and frequently comes on spontaneously. We note also coldness of the hands and feet. Sometimes lividity, local flushings and other signs of vasomotor disturbances are noted. The circulatory disturbances, like the digestive disturbances, are to be referred to diminished or defective innervation and are as much the expression of fatigue as are the other symptoms already considered. Secondary circulatory disturbances are not numerous.

The disturbances of the secretions, more especially of the skin and of the kidneys, are to be referred to defective innervation.

The sexual disturbances of neurasthenia are notably those of ready exhaustion—weakness and irritability. The patient complains, for instance, of diminished sexual power, of premature ejaculation and of diminution of the sensations normally accompanying the sexual act. Numerous variations of these symptoms, depending upon the sex of the patient and the habits as regards continence or incontinence, may also be present. They are of the nature of secondary manifestations, and sometimes give rise to that form of neurasthenia which has been described as sexual neurasthenia by some of the older writers.

There is reason to believe that if neurasthenia simplex lasts for a long time—that is many years—it may result in a premature senescence of the tissues; it then becomes incurable. I have spoken of this form of neurasthenia as *neurasthenia terminalis.*

DIFFERENTIAL DIAGNOSIS.—Hysteria is readily differentiated by the fact that there are always present some of the stigmata of hysteria, such as areas of anesthesia, palsies, contractures, special forms of cutaneous painful hyperesthesia, the psychic symptoms and the history of paroxysmal attacks. No such symptoms are present in neurasthenia. We should, however, bear in mind that every now and then neurasthenia and hysteria coexist in the same patient.

In regard to hypochondria we note first the absence of all physical signs, motor, sensory or visceral, with the possible exception of slight atonicity and catarrh of the digestive tract. Second, we note an all-pervading and convincing sense of illness, together with a fixed belief of the patient that he is ill and that he requires medical care. Sometimes the idea of illness centers about special organs, such as the eyes, the stomach or the sexual apparatus. It is noteworthy, however, that not one of the symptoms entering into the syndrome of neurasthenia is present. Vague sensations of all kinds are complained of, it is true, but the signs of chronic fatigue are absolutely wanting.

In regard to the neurasthenoid states, we should bear the same fact in mind. The symptom group of neurasthenia is conspicuous by its absence. Other vague nervous manifestations are present but they bear a psychic impress and we soon become aware that we have a mental case to deal with; it may be an early period of a melancholia, a paranoia, a paresis or possibly a neurasthenoid insanity.

Neurasthenia symptomatica likewise fails to present the symptom group of chronic fatigue. A careful internal examination will sooner or later reveal the evidences of actual visceral disease, such as an unsuspected ulcer of the stomach, chlorosis or some other exhausting affection. I may remark in passing that we never find changes in the blood in neurasthenia. It is not an uncommon error on the part of physicians to believe that in neurasthenia we have anemia. As a matter of actual fact such a condition is never present.

The Treatment of Neurasthenia.*

By CHAS. K. MILLS, M. D.

It is necessary in order that my views with regard to the therapeutics of neurasthenia should be clearly presented, to say a few words about its definition and nature. Recently some tendency has been shown to return to the views which prevailed before Beard, in 1880, impressed the profession and the community with the idea that neuras-

*Abstract of paper.

thenia or nervous exhaustion deserved separate recognition in our nosology. Dana, for instance, in a paper significantly entitled "The Passing of Neurasthenia," would relegate the majority of cases so diagnosticated to the psychoses, and of the cases left he believes that many should be regarded as illustrations of nervous disorder dependent upon the disease of nonnervous organs. I do not, however, accord with the view that all cases, or nearly all cases, come either under the psychiatric pale or are to be regarded as instances of symptomatic neurasthenia. While neurasthenia is not as common an affection as many suppose, it is a distinct clinical entity whose cause is overfunctioning or undue expenditure of nervous energy, and whose manifestations are symptoms and signs which indicate nervous weakness and nervous irritability. It is a true fatigue neurosis and the expression "irritable weakness," often used, is one fairly descriptive of its chief characteristics.

This reference to neurasthenia as a psychosis and a symptom of disease outside of the nervous system suggests a word or two at the outset about the treatment. While it is true that the insane may be neurasthenic or the neurasthenic become insane, the terms neurasthenia and psychosis are not interchangeable; nevertheless a psychic element which has its underlying cause in heredity is present in most cases of true neurasthenia. From first to last the body as well as the mind of the neurasthenic should be treated, suggestion and encouragement, which is continuing suggestion, being potent factors in the successful management of the disorder. Another fact which has some bearing upon the question of the existence of genuine, uncomplicated neurasthenia is that in symptomatic neurasthenia, unless the neurasthenic element is recognized in the therapeutic measures adopted, the treatment instituted with only the primary causal conditions in mind, will probably meet with little success. The proper method of treatment in symptomatic neurasthenia is one which takes into consideration both the neurasthenic and the underlying nonnervous disease. Whatever is done for heart, stomach, liver, kidneys or blood, the patient needs also mental and physical rest and the inspiration of well-directed suggestion.

A single illustrative case may be of value in this connection. A young married man came to me from a distance to be treated for neurasthenia. He had gradually become more and more nervous, irritable and depressed. He occupied an important commercial position, but not one sufficiently calling upon his energies to entirely

account for his breakdown. He suffered from an annoying vitreous opacity and an old orchitic trouble; also from a congenital, partial arrest of development of one lower extremity. His mind had become concentrated on the symptoms and conditions which were not in themselves sufficient to cause any serious apprehensions. He had worried himself into a state of extreme neurasthenia because of affections easily cured, or at least relieved. The first thing necessary to do in this case as in so many others, was to remove the patient from his environment and to put him on as complete rest as possible, and to forcibly impress him with the idea that all his annoying symptoms were transient, or at least could be remedied, and that no reason existed why he should not in a short time be in as good health as he had been one or two years before. Proper attention was given to his eyes, to his somewhat crippled limb, to his genitalia, but at the same time he was placed upon a thorough rest treatment, at first nearly complete and later made partial. Isolation, massage, electricity, hydrotherapy and other measures, hereafter to be referred to, were used, and as they were gradually withdrawn, systematized exercises and increasing occupation were substituted. The man made a good recovery in less than three months.

Before taking up special measures for the treatment of neurasthenia, a few words should be said about its prophylaxis, and it would be time saving to include in these remarks suggestions regarding not only the methods of preventing its occurrence, but also of its recurrence after recovery through time or treatment. The age is strenuous. Notwithstanding the pace which is set in almost all walks of life, however, many succeed in passing to middle life and later, and then succumb not to neurasthenia, but to arteriosclerosis or some other degenerative disease. The predisposed neurasthenic who tends to early exhaustion of his nervous system may, in spite of his neuropathic heredity, have within him great possibilities in some directions, and it is well worth while to conserve and develop his powers. The physical and mental endowments and limitations of the child should receive the close attention of the parent and the educator. The seeds of neurasthenia may be sown in the preparatory school or in the college, and especially in the latter, where so often a false standard, or at least one that is not suited to the average members of a class, is set. After the general education or training of the youth is completed, another great step towards the prevention of neurasthenia is that which is taken when care is exercised, both by the individual and his advisors,

in the choice of an occupation which is suited to his inherited endowments.

Passing now to the question of the prevention of neurasthenia in those engaged in active pursuits, it should be remarked that not a few of those who suffer from nervous or other breakdown do so because their lives and work are full of unrest. Of two business men who have equal amounts of work to do, and are practically equal in physical strength and mental capacity, one goes about his tasks with a steadiness and system that do not wear either upon himself or those with whom he comes in contact; the other with such restlessness and unnecessary output as to keep himself in a half exhausted state and those around him disturbed and disquieted. Perhaps his unrest is shown in the unnecessary steps that he takes or the unnecessary rapidity with which he takes them; in talking too long or too excitedly; in driving when leading would do better; in brief, in expending more energy than is necessary even for the full accomplishment of the work in hand. The feelings of those compelled by fate to keep company with these useful but irritating mortals is best expressed by the slang expression, "Give us a rest"; but as a rule they neither rest themselves or let anyone about them rest. One man does his work with smoothness and with only that loss of vitality which is easily repaired by his daily food and sleep, the other is always giving out more than can thus be supplied. One saves his forces at the same time that he uses them, the other is wasting much that he might easily save. One physician is worn out before his hours of work are half expired; the other goes evenly and quietly through the hard day's work. The work that nags and harasses one man scarcely ruffles the other.

Probably no one thing is more important in the prophylaxis and in the treatment of neurasthenia than the avoidance or prevention of worry. Genuine neurasthenia seldom occurs in one with a healthy inheritance, simply through persistent and severe mental work. The biographies of scholars, technologists and professional men who have obtained celebrity afford ample evidence of the truth of this statement. On the other hand, it is a matter not only of history, but of common experience, that anxiety and worry, whether caused by domestic disturbances or embarrassments and perplexities in business and professional life, are fruitful sources of the exhaustion and irritability which are the sign manual of neurasthenia. Probably no one factor is more important in the production of the neurasthenic state than the

worries of domestic life. *Res angustæ domi.* The student of mathematics, of law, of medicine or of any vocation requiring intellectual capacity and persistent labor may continue his work through long hours for many weeks or months with no more visible result than normal mental and physical fatigue. But add to this an embarrassing or nagging domestic life, and neurasthenia is one of the most frequent consequences. One's life should be so regulated, not only by himself, but with the assistance of those by whom he is constantly surrounded, that unnecessary anxiety and worry are as far as possible eliminated.

Passing now to a consideration of the treatment of neurasthenia, before taking up the different therapeutic methods and measures, attention must be directed to the fact that at least two sets of neurasthenic patients need to be recognized in considering plans of treatment. One set must be treated at home or not at all because of financial or other reasons, and another, the patients included in which can be removed from home and their usual environment and undergo a comparatively expensive form of treatment. The methods to be employed in the two classes of cases are fundamentally the same, but differ in their manner of application and in the degree in which particular measures can be carried out. The general practitioner is often confronted with the problem of what to do with a neurasthenic patient who cannot undergo an expensive rest treatment, and who indeed may be unable to secure the advantages even of a short journey or change of climate and surroundings.

Whether the patient is treated at his own home or in a house or hospital where the socalled rest cure is undertaken, the most important measures of treatment will be the same. These are rest, regulated diet, recreation, change, massage, electricity, exercise, work and medicinal and special therapeutic measures. The keynote of the treatment in all cases is rest. As fatigue due to overfunctioning is the most important element in the development of true neurasthenia, it is a necessary corollary that prevention of the over-expenditure of nervous energy demands first consideration as a therapeutic measure. The first thing that the physician should do is to look into the exact manner of life led by the patient, man or woman. This can often be so readjusted as to bring about a less wearing existence.

A word might be said here about underrest, which is not *quite* the same as overwork. Even with time and opportunity at their disposal, many business and professional men, and in fact many in all walks of life, do not know how to rest even when they have time

and opportuinty. They worry and drive themselves even in their efforts at diversion and recreation; in all things they unnecessarily waste energy. They should be taught to do their tasks and duties with less mental and physical output; to sit when they would ordinarily stand, to talk quietly instead of with undue excitement, to substitute complacency for anxiety, and to work steadily without considering too much the time of completion of the task before them.

The mode of rest treatment pursued without taking patients from their homes is usually spoken of as the partial rest treatment. The method of carrying it out necessarily varies somewhat with the conditions in which the patient is placed. Some matters are of first importance. The hours of sleep should be largely increased. Many men and women who are in the habit of being in their beds only eight hours, or even less, can readily increase the time to twelve or fifteen hours without really interfering with their work. Fourteen to sixteen hours of recumbency out of the twenty-four should be taken whenever it is possible to accomplish this result. It is best brought about by going to bed at eight or nine in the evening, and by taking one or two hours during the day, preferably late in the morning or early in the afternoon.

All disturbing influences should be eliminated during the periods of day and of night rest. The woman should know nothing of household cares or of her children; nor should the man be troubled with anything either within or outside of his immediate household.

With regard to the use of food, electricity, bathing, diversions and medicine, the remarks which will be made later when discussing the full rest treatment are almost equally applicable in discussing the partial rest treatment either at home or elsewhere. Some modifications of the suggestions given when considering the full rest treatment as regards the administration of food and the use of exercise, diversions, etc., of course, will be necessary, but these are chiefly such as would be so apparent as to need no detailed consideration. It might be well, however, to say something with regard to massage used at the homes of patients. For business men and for women who are much engaged with domestic and other duties during the day, a good plan is to have the supper between six and seven, to spend the time between this meal and 8:30 or nine o'clock in quiet conversation, reading or amusement, then to have general massage for forty-five minutes to an hour. This treatment may prove not only restful to the patient, but may aid in the bringing on of sleep when insomnia

is present. Careful arrangement should be made so that the patient will not be disturbed at the conclusion of the treatment. General faradization may sometimes be alternated with massage to the advantage of the patient, although on the whole it will prove less useful in the home treatment than massage and Swedish movements.

Milk and eggs should form the standby in bringing food to the maximum in the home as well as in the full rest treatment of neurasthenia.

Walking, horseback riding, golf and tennis playing are among the most useful outdoor exercises and diversions for neurasthenics, but when used the greatest care should be taken not to bring on undue fatigue. All modes of exercise should be used sparingly at first. Automobiling is, in my experience, a nerve exhausting method of taking exercise and diversion. The reason for this is that those who resort to this method of transportation and exercise usually show little judgment in regard to speed and keep themselves over exhilarated and in a state of nervous tension.

Let us next take up the subject of the complete rest treatment, a method of great value for a large percentage of cases of neurasthenia. I might be permitted to say here a few words about its indiscriminate use. The mistake is not infrequently made of putting patients upon this treatment without due consideration, and as a consequence it falls into unmerited disrepute. Many cases of melancholia, for instance, are not well adapted to this therapeutic measure; in other instances of this disease one or two weeks of the treatment is sufficient, other measures being introduced rapidly, including moderate exercise out of doors. A purely hysterical case is not always helped by the rest treatment. Symptomatic neurasthenia often does well under this treatment, which, as a rule however, must be modified somewhat according to the nature and peculiarities of the case.

The main features of the complete rest treatment are: (1) isolation, (2) rest in bed, (3) regulated diet, (4) massage and Swedish movements, (5) faradic electricity, (6) systematized respiratory exercises, (7) bathing, (8) diversion and recreation, (9) medicines.

Without isolation this treatment will frequently be a complete failure. Again and again, because of the difficulties surrounding the removal of a patient from home, I have tried the experiment of isolating a patient in some portion of his or her own house; usually it is a flat failure. A woman who remains anywhere in a house in which she is accustomed to direct or attend to the wants or needs of others

can never thoroughly relax mentally and physically for periods of days or weeks. She may promise to give up servants, visitors, friends, children and husband during the alloted period of treatment, but in spite of herself, in nine cases out of ten, will not be able to carry out her promise. It is far better to attempt the partial rest treatment with an hour or two in bed during the day and ten or twelve from evening until morning, allowing the patient to be up and doing during the rest of the day, than to attempt the complete rest cure by what is supposed to be isolation in some part of the patient's own house. It is better, on the other hand, to have the treatment elsewhere than at home, even in those cases in which good judgment seems to dictate that the patient should be allowed occasionally to see some member of her family.

It may seem unnecessary to say that the rest should be in bed, but it happens sometimes that patients, as well as others, believe that rest in bed is necessary for only a portion of the day, the recumbent position on a couch or sitting taking its place in part. For the first weeks of the treatment, at least, the rest should be in bed and as absolute as possible. Whether the patient is allowed to feed herself can only be decided by the peculiarities of the case; in most instances she can, and the taking of food should be done in the half sitting position in bed, using a table. After several weeks, or a week or two, if the treatment is of short duration, the patient can be placed upon a couch for a portion of the day, and still later upon a couch and in a chair. This change should not be made until after a certain definite time is allotted for walking in the room. Even the position in bed is at times somewhat important; usually the head should not be too high and the patient should be encouraged to lie in different positions, that is, on the back or on either side and always with as complete muscular relaxation as possible.

One of the chief objects of the treatment is to rapidly or slowly improve the general nutrition of the patient by the skilful use of diet; I follow no fixed rule. Sometimes I begin with a complete milk diet, increasing in frequency and in amount, slowly or rapidly according to what seems to be the requirements of the individual case; cases, however, which do well on milk alone for more than a few days are not in my experience numerous. In some cases the diet may still be kept one largely of milk, adding only a few articles as raw or slightly boiled eggs, albumin water, Horlick's malted milk or some one of the forms of beef extract. In the majority of cases of neurasthenia the diet can

soon be made mixed. In almost all cases, however, certain articles should be eschewed and others should be given particular favor. Much depends upon the manner in which food is prepared; broiled and roast meats are to be preferred. Oysters should be given raw, broiled or dry panned. Green vegetables such as lettuce, spinach and celery can be used with considerable freedom. It is not necessary to exclude potatoes altogether as is sometimes advised, but they should be used sparingly either roasted or mashed. Peas and rice thoroughy well cooked, may be used and fruits not too freely. The lighter forms of dessert like tapioca, corn starch, spanish cream, cream puffs and ice-cream may be introduced after a time. The main object in the use of food is its increase to the point of full, or what would ordinarily be, over feeding without disturbance of the digestion of the patient. I find raw eggs a valuable addition to the ordinary diet list. They may be taken in numbers varying from four to twelve a day according to the circumstances and to the amount of other food taken. Beef extract gives a variety to the diet but does not add much to its real value.

Massage and Swedish movements cannot be dispensed with in the rest treatment. I can only give a few suggestions. As a rule, the massage can be given by the nurse who has charge of the patient; it is not always best that this should be done. The introduction of a masseuse from the outside may be either a useful measure or a disturbing element. Which it will be depends upon the patient sometimes, but more frequently on the masseuse. Massage at first should be given for a comparatively short time, thirty or thirty-five minutes, but later can be increased to forty, fifty or sixty minutes.

Electricity used only in the form of general faradization with a slowly interrupted current is less useful than massage, but often should be employed. Here again the method of its use is important. In not a few cases, the nurse who attempts to give faradic electricity to a patient is unskilful or irritating in her method of doing this. On the whole, I prefer the method of direct muscular faradization supplemented with gliding or labile currents applied to the entire limb or part. The nurse holding two moistened electrodes in one hand, passes from one muscle to another; then placing one electrode to the spine or in the neighborhood of the nerve plexus, the electrode is passed from point to point down the limb.

Generally I begin the use of systematized respiratory exercises early; sometimes after the second or third week and while the patient

is still in bed. These are, in the first place, movements of the upper and lower limbs and of the trunk accompanied by deep breathing. Later when the time comes for the patient to be taken out of bed for a period of half an hour, five minutes of this time can be given up to systematized exercises. One mode of exercise which has proved useful in my hands as a supplementary treatment to rest, massage and other measures, is slow respiratory exercises, either indoors or out of doors. For the indoor exercises I have for years made use of those given in a little book by Blaikie entitled, "Sound Bodies for Boys and Girls." It was intended originally for a school book, but the prescribed lessons correspond so well to what is required that they afford an easy method of ordering exercises. The physician or nurse can vary the exercises as seems best suited to the needs of the patient.

While bathing is useful in the home treatment of neurasthenia, it can be employed to greater advantage in the complete rest cure where time and attendants are at full command. A daily sponge bath, with or without the addition of alcohol, is perhaps the best all around hydriatic measure. Most neurasthenics will not stand cold sponge bathing, at least not at first, and those who, ill-advised or of their own initiation, resort suddenly to cold sponge bathing, or spraying or immersion in the hope of hardening and strengthening their nervous systems, may find that they have made a serious mistake. The cool or cold sponge, the spray, the douche and the immersion bath may prove beneficial to the neurasthenic, but usually a patient must be educated to them. With regard to the time of day when baths are taken, it is with sufferers of neurasthenia as it is with those in health, that the best time for one patient may not be that for another. Warm baths are usually best taken in the evening, tepid or cold baths in the morning, but there are many exceptions to these rules as to time.

In the daily schedule of a patient under the rest treatment diversion in the form of reading, conversation, games and light work like knitting are usually of use early or late in the course of treatment Considerable judgment may be necessary in the selection of suitable books and suitable games, but no rules can be laid down to govern this matter. The judgment and good taste of both physician and nurse, combined with the experience soon gained with the patient, will serve to guide in this part of the treatment.

A few words might be said in conclusion, about seasonal vacations, resorts, climate and travel. These remarks are of course, applicable to patients convalescing under the influence of rest treatment

or to others in whose cases it seems advisable to resort to change of climate and location rather than to indoor measures. Business and professional men and women whose manner of living calls for undue expenditure of nervous force, should have at least two periods of vacation during the year. One of these should be taken preferably at the usual time of such vacations; namely, between the first of June and the first of October. The number of weeks taken must, of course, be regulated by the circumstances and opportunities of the individual. Physicians and the community at large have come to recognize more and more the importance of the summer vacation, but the same is not true of the short vacation of late winter or early spring. It is a well-known fact that nervous disorders are more numerous and more severe in the early weeks of spring. If the busy man or woman could so arrange matters as to allow of a holiday of from two to three weeks late in February or early in March, in the most congenial climate accessible, it would be found that this would do almost as much in maintaining health and vigor as the usual longer summer vacation. Unfortunately February and March are usually a time of hard work and high tension, and yet much could be done to make a short vacation at this time popular if its value was fully recognized by members of the medical profession. The short vacation in late winter or early spring is usually best spent by going to some quiet and healthful resort in a climate less taxing than that in which the overweary man habitually dwells. For Americans north of the Maryland border, the Springs of Virginia, or of North Carolina, the southern seaside resorts, the Bermudas, Nassau, Cuba or Jamaica will be found desirable. Continuous travel is not usually a good therapeutic measure for neurasthenia. In exceptional cases, however, a trip to the Mediterranean or to Japan or elsewhere may prove useful, but in all cases the journey should be made under conditions which do not tax. Much sight-seeing and hurrying from place to place should be avoided. Very high altitudes do not agree with neurasthenics, although they may do well at resorts not higher than one to three thousand feet.

I have said little about the use of medicines in the treatment of neurasthenia, and this is because there is comparatively little to say. Attention should always be directed to the digestive tract; stomachic tonics, digestants and mild cardiac or metallic tonics and even the antispasmodics have some place. Among the remedies of most value are preparations of strychnin with lactopeptin, nux vomica and gentian, cascarilla, cactus, preferably in the form of the fluid extract,

arsenous acid, sodium and gold chlorid, zinc valerinate, and in some cases preparations of iron like the albuminate or sulphate. Veronal and trional are among the most valuable hypnotics. Bromids should, as a rule, be avoided, but can be used in moderation in particular instances, especially when the patient's condition is one of general nervousness and great irritability. In the majority of cases alcoholic preparations should not be used. Next, perhaps, to the sufferers from migraine and from hypochondria, the neurasthenic man or woman is the most frequent victim of the advertising pharmacy of the day. He turns in every direction for the nostrums which will take away his feelings of fatigue, discomfort and depression, and too often resorts to such vicious stimulant narcotics as Vin Mariani and coco-cola, or to the too relieving sedative anodynes like antikamnia and cocain combinations. These stimulant tonics, these sedatives, anodynes and narcotics of alluring name are among the worst enemies of neurasthenics as they are of other members of the community.

DISCUSSION.

MAJOR CHARLES A. WOODRUFF, U. S. Army: Nearly all surgeons in the Tropics have come across a form of neurasthenia which they have studied very carefully, not only with a view of finding the cause, but the cure. I called attention to this, in 1900, in an article published in the *Philadelphia Medical Journal*, and it has also been written about by other physicians who have had service in the Philippine Islands. It has been recognized sufficiently to be termed tropical neurasthenia. Prior to 1898 we did not know that there was such a condition and little was heard of it from India. This, I think, is because European physicians do not take the view of neurasthenia which American physicians do; consequently, when they go to India and find conditions of nervous character they are apt to call them by different names. Some writers assert that nervous conditions are much more common in men than in women, while Dr. Fales, an American, asserts that the reverse is true. The most important symptom observed in the cases of neurasthenia in the Philippines is loss of memory, an almost universal amnesia of greater or less extent. In the young men this condition leaves them as soon as they get home; in the older men it may last. I am watching a serious case of a returned officer living in Plattsburg. There is inability to remember recent events. Another form is the apepsia, which is found in nearly all diseases and which is almost universal in dysentery. Almost nothing except the simplest food will be digested. A soft-boiled egg will cause intense suffering. At home we speak of the indigestion of neurasthenics; in the Tropics it means starving to death. I have seen officers carried from the First Reserve Hospital to the ships to die suffering from absolute starvation, having lost tremendiously in weight. By the time they reach Japan they are much improved and upon arriving in San Francisco they have gained from 20 to 35 pounds. One gentleman who had been in charge of the hospital told me that he was ashamed

to tell his friends that he had been sick, but he had been carried on the boat to die. In trying to find a cause for this neurasthenic condition which is so universal in the Tropics, I ran across an article calling attention to the fact that in the human being, as well as in the lower animals, there is a pigment in the skin which is for the express purpose of protecting the underlying protoplasm from the short rays of light and not the long rays, an opaque armor. The author called attention to the fact that the more light there was, the darker were the skins of the natives. The article had fallen flat, little then being known of the deadly effects of light at that time, for Finsen had just begun his studies. Along these lines I made some investigations in the Philippine Islands and found among the soldiers that the blonds in 4 regiments had a morbidity rate very much larger than the brunettes, and a mortality rate almost double. I saw the same condition in families. Of two daughters, the blond might be very neurasthenic, but the brunette was comfortable and enjoying the climate. I found blond officers in a miserable condition and the darker skinned men even better than they were at home. These observations led me to further investigations, and it was learned that in Scandinavia, in the central and southern part of Norway, there are more blonds proportionately than in any other part of the world. As we go down into Malta or the southern end of Italy there will be found hardly any blonds; eyes that are called light blue are gray and have considerable power to keep the light out. White men who go to India do not survive the third generation. If the white man goes too far out of his dark corner, death stares him in the face. These views were presented to the Medical Society of Northern New York and obtained from the members of the Society remarkable facts in relation to the treatment of tuberculosis. The general idea is that tuberculous patients should be sent to a place where there is plenty of sunchine, but instances were given of patients sent to New Mexico who, though cured of tuberculosis, had come back neurasthenic. While at Saranac a gentleman returned from Colorado for advice. He had been cured at Saranac and had gone to Denver to live. He complained that he was becoming exceedingly nervous. I noticed that he was one of the blondest men that I have ever seen. From the last Surgeon General's report of the sick and death rates, according to the various parts of the United States, I find that the largest sick rates as well as the largest death rates are in Colorado, Arizona and New Mexico. This is probably due to the increased number of sick persons sent there. The lowest death rates are in the Northwest corner of the United States: Washington, Oregon and Alaska, where there is a minimum of sunshine and clouds present almost 75% of the year; that is, we can have good conditions in spite of lack of sunshine. I personally know one man now living on the northwest Pacific Coast, who went there from here in 1890, remarkably neurasthenic and with an intense desire to get away from the sunshine. He is one of the strongest men on the Coast at the present time, and of course very enthusiastic on the subject of cloudiness as a cure for neurasthenic conditions. Five years' investigation of the effects of light has proven to my mind that it does have some effect in producing these neurasthenic conditions so common in America, which are not common in Europe, and the dreadful neurasthenic conditions that we find in the Philippine Islands. The practical point is that blond patients, in making a change of climate, must not be sent south. They should be sent north and only the brunette ones sent south. Neurasthenics are more

common in the south and are apt to be blond. The northern sanitoria are remarkably successful in curing them, whereas the condition is made worse in lighter climates.

DR. WHARTON SINKLER: The remarks of Dr. Woodruff will set us thinking seriously about the most suitable climate to which to send our neurasthenic patients. Not a single branch of the profession is exempt from many neurasthenics among its patients; and, as a matter of fact, every one of us at times is more or less neurasthenic, so that we all have reason to be deeply interested in the subject. All of us *think* we know a great deal about it, but neurasthenia is a disease which is not easy of diagnosis. I believe that it is as common to find that a genuine case of neurasthenia has not been recognized, as it is to see an organic disease which has been regarded as a simply neurasthenic condition. Only a few months ago I saw a patient who had been examined by a very able surgeon and believed by him to be a case of neurasthenia. The man had a syphilitic ulcer and obstruction of the esophagus which was slowly killing him. One of the commonest difficulties is the diagnosis between neurasthenia and hysteria. So often the two conditions are associated or run into each other that we have not the clear cut ideas about them which we should have. Neurasthenia is undoubtedly a fatigue neurosis. The majority of neurasthenics become such as a result of some unusual fatigue, overwork, overstrain, overstudy, anxiety or something of the kind. But, there are many neurasthenics who have not undergone great fatigue, strain, work or anxiety. Many persons in the ordinary vocations of life, whose duties are not onerous, become neurasthenic, showing that an inherent weakness in the nervous system tends to the development of the disease. Cases of neurasthenia in males are quite common and are often more obstinate and more trying to treat than those in women. A neurasthenic man will remain in that condition for years, and many cases are incurable. I think there is no disease in which the treatment must vary more than in this. In my experience the method of treatment, as to whether it shall be by rest cure or by exercise and occupation, must depend not so much upon his pocketbook as upon his temperament. Some patients are much benefited by the ordinary plan of rest treatment. Others do not do well under it. They are better with exercise, systematized occupations and being driven to exert themselves when they feel a disinclination for it. I have seen a man who did badly under systematic rest treatment get very much better when he went to a health resort and was forced to take active exercise. Therefore, we must discriminate in the treatment to be employed in our cases. Sometimes we can find by our study of the individual before beginning treatment which method will be best for him; but in many cases we have to learn by experience.

DR. JOHN K. MITCHELL: The question of diagnosis suggests an interesting point. Within a week I have seen one case of dilated stomach, with obstruction of the pylorus, one of locomotor ataxia—in the early stages, but distinct—one of exophthalmic goitre, and two cases of Bright's disease all sent to me with diagnosis of neurasthenia. This is but one week's experience, so that the diagnosis of neurasthenia may be said to be not only easy, but so easy that it seems to include a great variety of widely different conditions. Whether the treatment is "rest" or "rush" or, as one or my patients called the latter, the "go" treatment, it should be managed with great accuracy and punctuality. Whether

the patient is having the partial rest treatment described by Dr. Mills, or treatment by occupation and active exercise, a very important and I think, perhaps, a neglected part of it is this of precise punctuality and accurary. This is so true that some of the milder neurasthenic states are successfully treated by doing practically nothing but making them lead punctual lives in every detail. The indecision which is a cardinal symptom is helped by this because they have to decide nothing. Certain things are to be done at 9, 9.30, 10.30 o'clock, and so on. This treatment may be so arranged as to include a man's business or a woman's household duties. I find that a great many patients who do not do well if their hours for rest are not precisely regulated, but left to their own discretion, will go on perfectly well if the hour of rest and isolation is set down for them to be taken at a certain time and of a certain length. The fact is that the whole object of the treatment of neurasthenia is directed toward the conservation of energy and it is only by rest and punctuality that this can be done, and a proper economy of nervous expenditure can be obtained.

DR. CHARLES W. BURR: The most important thing in the study of neurasthenia is diagnosis. I was much impressed by this when, many years ago, I was a Hospital Resident. A man in middle life was being treated as a case of neurasthenia. For a time he did well, regained some strength and was able to walk a mile or two. He constantly complained, however, and bothered me very much by his whining. One night just after I had told the nurse not to call me through the night unless he really were very ill, he fell dead. Autopsy showed him to have been suffering from fatty degeneration of the heart. His neurasthenia was merely symptomatic. That case happening early in my career and concerning which I had no responsibility, made a profound impression on me and though since then I have repeated the mistake of supposing organic diseases to be neurasthenia, I am quite sure I have made the error less frequently on account of this patient whose ending was so tragic. Whether we have a true neurasthenia to deal with or merely a symptom can alone be determined by the most careful examination not only of the symptoms referable to the brain and cord, but of those referable to the heart, lungs and other viscera and the ductless glands. I do not believe that neurasthenia is a common disease. In dispensary reports it fills a large place, but I believe this is due to the fact that frequently dispensary patients are not as carefully examined as private patients. Hypochondriasis is frequently regarded as neurasthenia. Of course it is not. Those of us who treat hypochondriasis as we would neurasthenia necessarily fail. That is the reason many physicians think there is little merit in the rest cure. They do not give rest treatment to the patients who need it, and do give it to the patients who ought not to have it. After the rest cure is ended the patient should be compelled to take regulated exercises and should get back into his regular work gradually, not suddenly. There is a condition best called "general nervousness" in which the patients are not really neurasthenic but irritable without being exhausted. These people are really suffering from "boredom," and what they need is not rest but something to interest them; mental and physical work and play.

DR. WILLIAM G. SPILLER: It is well to emphasize the frequency of the association of hysteria with neurasthenia. I am not prepared to say that hysteria and neurasthenia are different manifestations of the same neurosis, and

yet this does not seem more improbable than the association of mania with melancholia would have seemed some years ago. Some writers even now believe that hysteria and epilepsy are one neurosis. I believe, however, that later we shall find a closer association between hysteria and neurasthenia than we now accept. It is not difficult to secure the necessary isolation for a private patient, but in the hospital wards it is difficult . This can be overcome in a way not altogether satisfactory but which has certain points in its favor. We may obtain a bed at the end of the ward and have it screened. I have often wished we could employ the curtained beds so common in the Salpêtrière. Work is sometimes as necessary as rest. In the case of a young girl, of about 22 years, with deficient vitality every effort was made to find some cause for the deficient vitality without success. She had been in the hands of many skilful physicians, had taken the rest cure, and yet she had very little reserve force. If she led a routine life she got along fairly well. It was necessary to find work for her that would increase her vitality, but it must not be exhaustive. I succeeded in getting her interested in horseback riding and it had a decidedly beneficial effect. She had someone with her who watched her and never allowed her to become exhausted. I mention this case to show that hard and fast rules will not always apply, and that we must make a careful study of every patient.

DR. A. C. BUCKLEY: I should like to speak with reference to the differential diagnosis of the socalled traumatic neurosis and posttraumatic neurasthenia. It has been my opportunity to observe a number of cases of posttraumatic neurasthenia and I have noted that in practically all of them, after the posttraumatic shock had passed off there was a temporary period of almost normal health before the appearance of the true neurasthenic symptoms. I should imagine, on the contrary, though I have not had experience, that in the pure traumatic neurosis the symptoms would follow more or less closely upon the apparent injury.

DR. FRANK WOODBURY: There is a class of cases which comes to us and unless we recognize the cause, we are apt to pass them on simply with the diagnosis of neurasthenia. I refer to the patients, seen in all large cities, who aresuffering from the injurious effects of water gas; cases of chronic carbon monoxid poisoning. About 20 years ago, at a meeting of the Public Health Association, Dr. Henry Hartshorn read a paper on the "Dangers of Water Gas" and a series of resolutions was adopted protesting against the introduction of water gas as an illuminating agent; but without avail. At the present time our illuminating gas is principally water gas, and, as the plumbing of many houses is of all ages and is very apt to be defective, many of our fellow citizens are constantly inhaling it. In one case of very marked neurasthenia I found upon investigation, that the air of the house was sensibly vitiated by defective gas fixtures, and that there was a constant outpouring of this carbon monoxid in the sleeping room. In the consideration of symptomatic neurasthenia, I think we may include such cases within a group designated by Beard as toxic neurasthenias. I think we have in the chemistry of the storage battery a good analogy to the nervous system. We know from experience that some of our medical storage batteries will hold a charge for a long while; others only for a very short time. The same is true of the nervous system. In the neurasthenic individual, the amount of nervous energy which he is capable of storing up is inadequate to the

performance of the duties of his daily life. From this standpoint we can have all grades of neurasthenia. This is directly in harmony with Dr. Pickett's definition of neurasthenia as a disability rather than as a disease. Strictly speaking, the neurasthenia is an expression describing the relation of the individual to his environment. A person may be neurasthenic and yet have no symptoms whatever, until he is called upon to do some ordinary work, when his disability is manifested by early fatigue and incapacity. In the treatment of a patient with symptoms produced by or depending upon neurasthenia, therefore, one of the first things to do is to adjust his environment to his capacity.

PROCEEDINGS

OF THE

Philadelphia County Medical Society.

NOTICE.

At the Business Meeting, held January 17, 1906, the Society voted to discontinue the publication of the Proceedings. Therefore, the present number, which completes Vol. XXVI, will be the last issued.

The Quantitative Estimation of the Stomach Contents.

BY JOSEPH SAILER, M. D.

[Read November 22.]

In order to devise a rational treatment for diseases of the stomach we must know three things. First, the condition of the gastric mucous membrane, that is, whether any pathologic lesion, such as chronic or acute inflammation, a neoplasm, or other lesion exists. Second, the rapidity with which the stomach empties itself. Third, the composition of the juice secreted by the stomach.

The customary method of examining the gastric contents has been to administer a test-meal, and then, at the expiration of a certain time, to remove it, test the acidity present, and perhaps the degree of digestive activity. This method, however, fails to give very accurate data. The degree of acidity depends upon the quality and quantity of the gastric juice, and upon the amount of the test-meal that has been retained, and as these factors may vary independently it follows that it is impossible to determine which one is of the greatest influence. Thus, Sahli, in advocating his method, remarks that occasionally the more accurate information it gives has shown that a patient apparently suffering from subacidity really has a gastric juice excessively rich in acid.

The work of Pawlow, which has almost reconstructed the physiology of digestion, indicates clearly that our previous methods are in-

adequate as well as inaccurate. These deficiencies in the methods of examination have been recognized for a long time, and numerous attempts have been made to correct them, but none of them have as yet received general recognition. A clinical analysis of the stomach contents should enable us to determine two things. First, the total quantity of the stomach-contents at the time the test-meal is removed; second, the relative proportions of stomach-contents and gastric juice.

The methods for determining the total quantity of the gastric contents all depend upon the principle first enunciated by Mathieu and Rémond, in 1890. This principle was not new, but they claimed that the application was. It consists of the fact that, given a solution containing a measurable substance, if a portion of that solution be removed, the remainder diluted with a definite quantity of water and the substance estimated in each, it is possible to calculate the amount of material which has been diluted. Or, to put the matter concretely, the authors contended that if, after removing the test-meal, a definite quantity of water (from 200 to 400 cc.) were poured into the tube, mixed with the remaining stomach-contents, and then withdrawn it should be possible, by estimating the total acidity in each portion and knowing the quantity of water added, to determine the remainder of the stomach contents. This of course is easily done by remembering that the total acidities vary directly as the sum of the diluting water and the remainder, varies to the remainder. Or, if A= the total acidity of the undiluted portion; A^1= the total acidity of the diluted contents; Q= the quantity of water added; and X= the remainder of the stomach-contents, then the proportion is as follows:

$$A : A^1 :: Q+X : X. \quad \text{Or:—} X = \frac{A^1 \times Q}{A - A^1}.$$

The difficulties of this method were early recognized. According to Oppler, saliva might be mixed with the first portion, reducing the total acidity. In tenacious fluids it might be difficult to obtain the first portion. If there is any vomiting it would vitiate the results, and in specimens with a low total acidity the calculations would be untrustworthy. Other defects which have occurred to me in the course of my experience with the method, I shall speak of later.

In 1895, Straus suggested a modification of this method, which

consisted in the fact that he employed the specific gravity of the two portions, instead of the total acidity, for the purpose of indicating the degree of dilution. The method was as follows: The test-meal was expressed in the usual way; then 100 cc. of water were poured into the tube, and the patient shaken by grasping him firmly around the hips in order to secure a thorough mixture. This was then expressed and the specific gravity of both fluids taken with an ordinary urinometer, avoiding the use of the picnometer. Straus devised a rather complicated formula that determined at once the total quantity of the stomach contents, but Reichman suggested that, if only the remainder were calculated, the following brief formula would be sufficient: $X = \frac{A\ (S^1 - 1)}{S - S^1}$

In this formula X= the remainder; A= the quantity of water added; S= the specific gravity of the undiluted portion of the meal; and S^1= the specific gravity of the diluted portion of the meal.

This method, of course, is often difficult to carry out, particularly if the first portion of the stomach contents is tenacious.

Cohnheim, in 1900, suggested a modification of the Mathieu-Rèmond method, to be used, however, only in cases of subacidity. It consists merely in adding an acid solution to the stomach contents before removal, in order to be certain that the acidity would be sufficiently high for convenient estimation. Cohnheim devised a complicated formula for the purpose of expressing his results which, when finally reconstructed, results in the following:

$$X \text{ (the remaining gastric contents)} = \frac{Q \times (A^2 - A^3)}{A^3 - A^1}$$

In this formula Q = the amount of HCl solution employed; A^1= the total acidity of the test-meal; A^2= the total acidity of the acid solution, and A^3= the total acidity of the second portion.

Cohnheim was the first to test the efficiency of the mixture. He found that sinking and raising the funnel three times produced a mixture that gave the same results for total acidity in various portions, and therefore the mixture must have been good. The objection to the method that the mixture might be poor, applies to all other methods, and, he believed, could be overcome. He found, moreover, that when

there was much mucus in the gastric contents free dilution diminished the amount of error.

In the meantime, other men were working with certain modifications of the method, which may be mentioned for historic interest, although apparently they are of so cumbersome a nature that they have been abandoned.

Tappeiner used sugar and salt solutions, estimating the diminution in the amount of sugar or salt as a result of the dilution, to indicate the remainder.

Jaworski employed practically the same method.

Moritz and Goldschmidt, working in the laboratory of the former, used glucose solutions, estimating the degree by Moritz's own method. Goldschmidt, however, also employed Straus' method, devising a simple way of calculating the result. He dilutes with 50 cc. of water, then filters both stomach-contents and the diluted remainder. He takes the specific gravity, and to 50 cc. of water adds sufficient of the stomach-contents to make the specific gravity equal to that of the diluted portion. The amount of stomach-contents added, of course, equals the remainder. This method would be unavailable if the test-meal were less than the remainder. Control experiments that he made apparently in vitro, although he does not so state, are said to prove the accuracy of the method.

Sörensen and Bradenburg estimated the total nitrogen before and after dilution, a method too complicated for clinical purposes.

For the past year I have been working with the method of Mathieu and Rèmond in order to determine, if possible, first, whether the method is as accurate as its advocates claim, and second, whether the estimation obtained from the estimation of the total stomach-contents is of importance in diagnosis.

My first experiments were made with a solution of HCl, dividing into two portions, measuring each, and then diluting the second portion, making the estimations and calculation in the usual way. The results were of course entirely satisfactory. When, however, instead of solutions of dilute HCl, I employed test-meals, dividing into two portions filtering the first, then diluting the second, filtering, estimating the total acidity of each, and making the calculation, I found that at first the error was so great that the method was practically valueless. After a series of tests I found that at least part of the error was caused by filtering the stomach-contents, the total acidity in the filtrate being, as a rule, considerably lower than in the unfiltered portion.

Further investigation revealed a second error. If a test-meal is allowed to stand, and then portions are removed for testing the total acidity, it will be found that at different levels the acidity varies considerably; as a rule, the low levels showing a much higher acidity than the upper levels, unless, as sometimes happens, there is a considerable amount of mucus present. It, therefore, became apparent that to get a constant definite result from any test-meal, it was necessary to mix the test-meal thoroughly before removing any portion for chemical analysis. If the test-meal is at all thick, as it often is, this thorough mixing was found to be practically impossible, so that I finally determined to dilute the test-meal considerably before mixing. This dilution was usually made with nine parts of its bulk of water. In this degree of dilution it becomes fluid and can be thoroughly mixed by pouring repeatedly from one vessel into another.

Finally, by observing carefully the principles of dilution and thorough mixing, I was enabled to obtain fairly satisfactory results on stomach-contents tested outside the body. This, however, was no proof that the estimation made upon the patient is accurate. A considerable number of errors may occur in actual practice. First, the stomach-contents may not be thoroughly mixed, so that the portion withdrawn does not represent accurately the total acidity of the gastric-contents. Second, saliva or mucus may be mixed with this portion during withdrawal, altering its total acidity. Third, in the mixture of the water with the remainder, either, as is usually the case, a too dilute solution will be withdrawn, or one that is too concentrated, in the first case decreasing the apparent remainder, in the second case increasing it. Fourth, some of the stomach-contents may escape into the intestine during the operation, thus escaping dilution, and rendering the final result less than it should be. Fifth, there may be continuous secretion of gastric juice between the withdrawal of the first and second portions, rendering the acidity higher, and tending to increase the final result. It will be observed that some of these errors have a tendency to counterbalance others, particularly the fourth and fifth.

Certain other errors are so obvious that it is merely necessary to mention them. The amount of stomach-contents first withdrawn may be too small to make the estimation of any value. This is occasionally also true of the diluted portion. The patient may vomit during the operation, or may secrete a considerable quantity of saliva which may be inadvertently expectorated into the test-meal or swallowed, in either case rendering the result uncertain.

The difficulty of securing a thorough mixture of the second portion was perceived by Mathieu and Rèmond, and all subsequent investigators. Practically only two methods have been devised to overcome it, first, that of Mathieu and Rèmond, which has been used by the majority of subsequent investigators, and is particularly lauded by Cohnheim, depressing the funnel, allowing it to refill, raising, and then depressing again. Cohnheim states that, by repeating this procedure three times, he has been enabled to obtain a perfect mixture, and has proved this by testing separate portions. Second, the method of Straus of shaking the patient.

The method that I employ differs from either of these, although the principle controlling it is the same as that of the method of Mathieu and Rèmond. Using a bulb tube I compress the tube between the funnel and the bulb, and then alternately squeezing and relaxing the bulb, I force a powerful jet into the stomach-contents and then withdraw some of them into the bulb, the object, of course, being to create eddies by means of which the stomach-contents are thoroughly mixed. As I shall show later, I have reason to believe that neither this method nor that of Mathieu and Rèmond is invariably satisfactory. The technique that I have finally devised is as follows:

At the proper time after the meal has been taken, that is, about one hour for the bread and water meal, and about three hours for a proteid meal, a tube of fairly large caliber is introduced, and as much as possible of the meal withdrawn. Three hundred cubic centimeters of water are then poured into the tube and mixed as thoroughly as possible with the remaining stomach-contents, and as much as possible of this drawn off into a second vessel. The first portion is then tested by Congo red and phloroglucin-vanillin for free HCl. It is then measured, diluted with nine times its volume of water, and thoroughly mixed by pouring from one beaker to another a number of times. Fifty or one hundred cubic centimeters are removed and tested for the total acidity, and this operation is repeated once or twice. Usually the result should not differ more than one on the Ewald scale. It makes no difference, however, what method of notation is employed for stating the HCl. present.

The second portion of the meal is then thoroughly mixed by pouring from one vessel into another. Dilution is usually unnecessary unless the second portion be very thick. Fifty cubic centimeters are tested at a time for the total acidity, two or three tests being usually sufficient, for the variation is commonly very slight. If there is much

mucus in the second portion thorough dilution is required, and even then it may be difficult to get a constant result. The total acidity of the second portion is multiplied by 300, the product divided by the difference between the total acidities of the first and second portions, and the quotient equals the remainder in cubic centimeters.

Occasionally very extraordinary results are obtained. On several occasions the total acidity of the second, or diluted, portion has been greater than the total acidity of the first portion. This is especially likely to occur if the first portion obtained is small, and is possibly due to the mixture of saliva or mucus. In cases of lowered acidity the estimation of the second portion becomes very difficult unless a large quantity is obtained, and one or two hundred cubic centimeters can be tested at a time. If there is retention of the gastric contents, and a large remainder, control tests indicate that the mixture of water with it is imperfect, and the calculated remainder consequently too small.

The results obtained in several examinations upon the same patient show that, according to this test, the method is fairly satisfactory. I felt that it was necessary, however, to devise some more certain means for proving its accuracy, and for this purpose I used a second dilution of the stomach-contents. If the remaining stomach-contents are estimated by the method that I have given, should the second expression fail completely to empty the stomach and another measured portion of water be added, and the stomach-contents again calculated from this, it is obvious that the following equation should be correct:

B (the calculated remainder) + Q (the amount of water added) — N (the amount obtained at the second expression) should equal the remainder, as calculated by the third dilution, or B+Q—N=R.

I have made this test satisfactorily in all six times. Five times the result, as calculated from the third portion, was in excess of what it should have been. Once it was too little.

The method, therefore, has not the degree of accuracy which has been claimed for it by foreign writers. I think that the chief difficulty is in the mixture. In all probability the chyme in the pyloric portion of the stomach, which is the most acid, fails to mix thoroughly with the first water of dilution. Therefore, the second portion has a lower total acidity than it should have. It mixes, however, partially with the third water of dilution, and gives it a proportionately high acidity, so that the calculated third portion is very much too great.

It does not follow, however, from the results of my experiments, that Mathieu and Rèmond's method is to be wholly condemned, nor

is it to be supposed that some of the other methods employed (that of Straus, for example) are any better. All these methods depend for their accuracy upon a thorough mixing of the stomach-contents before expression, and upon the thorough mixing of the remainder with the fluid used for dilution. It has hitherto been assumed, somewhat too readily, I believe, that the thorough mixing of the chyme before expression took place naturally. And it has been assumed by previous investigators, particularly Cohnheim, that if the diluted second portion showed the same degree of acidity in different parts, we were justified in believing the mixture to be perfect. Notwithstanding these two defects, the method in general gives fairly approximate results, which are much more desirable than pure guess-work. If a second dilution is employed the result will indicate whether the estimated remainder is too much or too little.

The information which this method attempts to obtain is, I believe, essential to a clear knowledge of the condition of the stomach, because it is indispensable to the second important test, the estimation of the proportion of test-meal and gastric juice in the stomach contents, by means of which we would be able to determine with a high degree of accuracy the gastric motility, and the exact composition of the gastric juice, two points that our previous methods of analysing the stomach contents have left entirely to guess-work.

Therefore, I believe that an effort should be made so to perfect the technique of this method that the results obtained will be sufficiently accurate to enable us to proceed to the second estimation either by one of the methods already suggested, or by some other method which offers satisfactory results.

In an attempt to perfect the method I have combined the second and third portions, and, by calculation, estimated the total acidity of these portions for a total dilution of the two quantities of water added. Presumably the approximate result by this method is very much closer, and I am inclined to believe that, if, instead of diluting and attempting to mix once, we dilute and mix two or three times, the final result will reach a degree of accuracy that will enable us to proceed to determine very closely the actual condition of the gastric secretions.

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Hyperesthesia of the Gastric Mucous Membrane and Its Treatment.

BY J. DUTTON STEELE, M.D.

[Read November 22.]

I wish to consider in this brief communication various questions connected with the symptom-group that is usually spoken of as functional hyperacidity. The use of the term functional, excludes all structural changes in the gastric mucous membrane, such as ulcer and the lesions arising as the result of marked stagnation of the gastric contents. It also excludes diseases of the adjacent organs, which by local irritation produce excessive acid secretion, such as duodenal ulcer, gall stones and chloesystitis. I wish to show that the increase in hydrochloric acid secretion in cases of so-called hyperacidity is not the only factor in the production of symptoms, but that the pain is produced quite as much by gastric hyperesthesia as by an excess of acid.

Among 100 consecutive cases of gastric disease occurring in my private practice, seventy-nine may be fairly considered to be due to purely functional disorders without demonstrable structural change in the stomach. These figures suggest that a very large proportion of disorders of the stomach which a medical man sees in his private work are functional as compared with organic or structural lesions. In round numbers functional disturbances from reflex causes or local neurosis are responsible for three-fourths of the cases with gastric symptoms that we are called upon to treat in our private practice.

I have assumed that the normal limits of total acidity are from thirty to sixty, recognizing that these are arbitrary limits often overstepped in both directions in health. I have assumed that the total

acidity fairly represents the hydrochloric acid secretion, provided it can be shown that there is not a decided amount of organic acid present. Emphasis must also be laid upon the fact that in tabulating the results of gastric analysis, we must deal in round numbers, since the best of our present methods are faulty and approximate only. Therefore, I may be pardoned if I assume sixty as the upper limit of normal gastric acidity. Of my seventy-nine cases, twenty-three showed a total acidity above sixty and can be placed in the class of hyperacidity. This is nearly one-third of the total number. Twenty-nine were between the normal limits of thirty and sixty; twenty-seven were below thirty. Lichty, of Pittsburg, in a recent paper, (*American Medicine*, October 28, 1905), states that in his experience of 225 consecutive patients (not necessarily exclusively functional) about one-third showed more than the normal amount of acid.

THE RESPONSIBILITY OF HYPERACIDITY FOR GASTRIC SYMPTOMS.

Of my twenty-three cases of hyperacidity, all but two suffered more or less sharp pain coming on about the height of digestion and relieved by food or alkali. This may be considered the most common characteristic symptom of the morbid condition known as hyperacidity. In two cases, increase of acid was discovered in the routine examination of patients without gastric symptoms. Of the twenty-nine cases within the normal limits, eleven had this form of pain or discomfort, which is considered characteristic of hyperacidity. But a still more noteworthy fact is that three cases of total acidity under thirty quite constantly suffered from this form of pain, which came on some hours after eating and was relieved by food and alkali.

To summarize: (1) Many cases with a total acidity within the normal limits or below, suffer with the form of pain that is usually considered to be due to an excess of acid. (2) A certain proportion of cases showing an amount of acid above the normal exhibit no gastric symptoms whatever.

This apparent departure from what our ideas of hyperacidity have led us to expect may be explained by two suppositions.

First, our methods of estimating gastric secretion are faulty. Our test breakfast, even our test meals, are not always sufficiently stimulating to the gastric mucous membrane to show what the stomach glands are accustomed to do under usual circumstances. However, almost all my cases were examined more than once and with different meals, and as I have said, I have not attempted to draw sharp distinc-

tion, but have tabulated each case where the general average of examination showed it to belong. Therefore, we can largely disregard this phase of the subject.

Second, it has long been recognized that some other element beside an excess of acid is required to produce gastric symptoms in hyperacidity. This second element is a sensory neurosis producing hyperesthesia of the gastric mucous membrane, which renders it intolerant of the increased free acid. If this hyperesthesia is not present, then hyperacidity will not produce gastric symptoms. This explains the two cases in my list and the cases referred to by von Noorden and Riegel, in which there was a total acidity much above the normal without gastric symptoms. If hyperesthesia is present and at the same time the acid is increased, then there will be pain at the height of digestion relieved by food and alkali. If the hyperesthesia is more intense, then even normal amounts of free acid will cause pain and in the more severe grades of the sensory neurosis, even a subnormal amount of acid will produce symptoms and discomfort. That is, if the hyperesthesia is severe enough we will have the symptoms usually associated in our mind with hyperacidity even though the acid secretion is below normal. The clinical lesson for us in this is that we must not be surprised or thrown off the track in such cases when with a clinical picture of hyperacidity we find normal or subnormal gastric secretion. For in these cases the hyperesthesia is the condition against which our treatment is particularly directed and the degree of the acid is a secondary consideration.

I have found that hypersecretion, both alimentary and continuous, is uncommon among the class of patients that makes up one's private practice. My list includes but three cases of hypersecretion. I need not speak of the laboratory findings in this condition. Its symptomatology in my experience is that of a very obstinate hyperesthesia and hyperacidity which do not yield to ordinary remedies and are often associated with severe paroxysms of pain and vomiting which are probably due to tonic spasm of the pylorus.

TREATMENT OF HYPERESTHESIA.—It is needless to say that removal of the cause is the most important part of the treatment. In my series of thirty-five cases of hyperesthesia, fourteen were women and twenty-one men. The women were almost invariably of the neurotic type and in most of them (eleven cases) the gastric symptoms seemed to be a manifestation of this condition. The men were chiefly brain workers; nine were students, three physicians, two lawyers and

three clerks, or seventeen brain workers in a total of twenty-one cases.

The element of overwork seemed to play an important part in the production of the neurasthenic state; thus, of the total of thirty-five cases, eleven men and three women were distinctly overworked or under some nervous strain of responsibility or anxiety. Abuse of tobacco seemed to be responsible in four cases, of alcohol in one, and abuse of other narcotics (morphin) in one. Improper eating appeared to be the exciting cause in two cases only, and here the condition was probably a mild gastritis acida.

BREAKING OF THE VICIOUS CIRCLE.—In these cases there are usually certain morbid conditions which may be the direct result of the disturbance of gastric function or may be merely coincident with it, but which in either case have a deleterious effect upon the organism, and together with the primary affection form a vicious circle. To break this circle is often absolutely essential to the patient's improvement.

The first of these conditions is *malnutrition*. Although there is usually abundant gastric secretion the pain makes the patient very careful in his diet and the result is that he is frequently over cautious. This must be kept in mind in the regulation of the dietary. The importance of proper nutrition in the treatment of the neurasthenia, which is a frequent exciting cause of the gastric symptoms, need not be emphasized.

The second of the associated conditions that must be watched for is *anemia*. A very moderate degree of secondary anemia of the chlorotic type was the usual blood change in my series. In none was there a true chlorosis. I believe that the condition of the blood is an important element in these cases although the anemia is usually not of a severe type.

Constipation is the third important link in the vicious circle. A marked degree of constipation was present in fifteen of my twenty-one cases of hyperacidity. It is generally recognized that constipation plays some part in the symptom complex of these cases of hyperesthesia and hyperacidity. von Noorden goes so far as to claim that constipation is a direct cause of hyperacidity. I have always found that these cases are better when their bowels are moving freely, but have never been able to trace any direct causal relation between the two conditions. Perhaps the best laxative in the earlier and acute stages is the mixture of magnesia and rhubarb that is given to neu-

tralize the acidity. However, regulation of the diet must be relied upon for permanent relief. High injections of olive oil have proven a very useful remedy in some of my cases particularly when the constipation is very chronic.

SYMPTOMATIC TREATMENT.—If hyperesthesia is present the gastric acidity must be neutralized as soon as the height of digestion is passed, without regard to whether the acid is increased, normal or diminished. Naturally the amount of acid secreted regulates the quantity of alkali to be given and in the cases of hyperesthesia with low acidity the sedative part of the treatment is more important than the alkaline. When the acidity is high alkalies must be given freely. The best mixture in my experience is magnesium carbonate, and sodium bicarbonate in doses of twenty, ten or five grains, according to the degree of acidity. Powdered rhubarb may be added in cases with constipation. The alkali should be given as a rule two hours after meals.

THE USE OF SEDATIVES.—I have always found that a general nervous sedative is one of the most essential parts of the treatment of hyperesthesia, especially in the earlier stages. Such are the bromids, valerianates, sumbul and asafetida. In the cases of hyperesthesia with low acidity they constitute by far the most important part of the treatment, but their use should not be neglected in hyperacidity. After the acute symptoms are under control remedies directed toward the correction of the primary neurasthenia such as iron, and especially nux vomica, may be substituted. Local sedatives to the gastric mucous membrane as bismuth, silver nitrate and belladonna and atropin do much good in certain cases.

DIET.—When we recognize that the condition which we are called upon to treat in this class of cases is a sensory neurosis of the mucous membrane, we can understand that it is of the first importance that the food should be bland and nonirritating. Whether it is composed largely of proteids or not depends upon the amount of acid secretion but nonirritating it must be. In the first stages then the diet should consist of milk and eggs in their various forms, purees of vegetables, scraped meat and so on.

Later as the irritation subsides the dietary may be increased with due regard, (1) to the state of the gastric secretions; and (2) to the degree of malnutrition present. I have not the space to enter upon a discussion concerning the various dietaries suited to individual cases, but wish to call attention especially to butter fat in the form of

cream as one of the best foods for these cases. The value of fats in hyperacidity has long been recognized and I find butter fat tolerated best of any. In such cases fats act both by inhibiting acid secretion and helping nutrition.

TREATMENT OF THE PAROXYSMS.—The attacks of pain that occur in the course of the severe grades of hyperesthesia and hyperacidity are best relieved by prompt emptying and washing of the stomach by means of the tube. The pain may be combated by alkalies and sedatives but neither compare in promptness or efficiency with thorough cleaning of the stomach by washing.

The type of paroxysm which occurs in the form of cramps and pain coming on during the evening and at night are best prevented by thorough lavage at 6 P. M. followed by a nonirritating supper of eggs and milk. Occasionally in aggravated cases, attacks of severe and almost continuous pain occur accompanied by uncontrollable vomiting of sour material. These paroxysms resemble the clinical picture of gastric ulcer except that no blood is present in the vomitus or stool. I have found that the best means of controlling these attacks was by rest in bed and rectal feeding until the urgent symptoms are relieved. Then milk should be given by the mouth and the diet gradually increased as in an ulcer cure.

Although it is not always easy to prove, I am convinced that these more severe and obstinate cases of hyperacidity, which are associated with pain and vomiting are cases of hypersecretion and that the cramps and vomiting are due to tonic pyloric spasm which is produced by an abnormally large amount of acid stomach contents.

Clinically, hypersecretion differs from hyperacidity with hyperesthesia chiefly in the intensity of the symptoms, its resistance to ordinary means of treatment, and the attacks of pyloric spasm accompanied by vomiting.

The etiology of the two conditions appears to be quite similar and what has been said concerning the treatment of hyperacidity and hyperesthesia applies equally to hypersecretion.

The Surgical Aspects of Gastric Dyspepsia.

BY JOHN B. DEAVER, M.D.

[Read November 22.]

Not so many years ago it would have been considered presumptuous for a surgeon, as such, to express any opinion upon the subject of indigestion in connection with diseases of the stomach. But, when, through the daring and persistence of surgeons, diseases of the appendix were finally conquered and the hereditary terror of the peritoneal cavity had been in great measure dispelled by their achievements in the lower region of the abdominal cavity, it is in no way surprising that they next sought to determine what relief surgical procedures would bring in diseases of the biliary apparatus; and that, having demonstrated their successful application in these two portions of the abdomen, their next step was to attempt to relieve certain chronic affections of the stomach, in whose presence medicine had come to the limit of her resources, and was ready to retreat when the first convenient opportunity offered.

These remarks are not intended in any way to belittle the work that has been done, and that is still being done by medical men in the region of the upper abdomen; for probably no one knows better than myself how much modern surgery of the upper abdomen is indebted to experimental physiology and to the painstaking, if at times inefficacious therapeutics of the physician. It is indeed the proud boast of the physicians that men among their own number were among the first to appreciate the natural limitations of medical measures in certain abdominal diseases which have recently become amenable to surgical treatment, and that it is in reality owing to these very men, that there is spread before us a field full of such brilliant possibilities of surgical triumph as exists today in the surgery of the upper abdomen.

I speak thus of the upper abdomen as a whole, because every surgeon of experience knows how frequently lesions of the first portion of the digestive tract and its attached glands, the liver and the pancreas, occur coincidently. And although I have chosen to limit my remarks this evening to diseases which are more strictly gastric in character, it has been rare in my own experience for a patient to present lesions of the stomach without also presenting lesions of the duodenum, of the bile ducts or of the pancreas. Indeed I think that the frequency with which such other lesions are the cause of, or at

any rate are associated with, gastric disorders is a fact which is slow to win appreciation from the profession at large. Rarely does a patient develop gallstones without also developing either coincidently or consecutively, perigastric or pyloric adhesions, which more often than not cause gastric symptoms, while the original cause of the mischief, the biliary calculi, may cause no discomfort whatever. In the same manner I am convinced that the frequency with which gastric ulcers are multiple, and with which they extend downward past the pylorus and become doudenal, is grossly underestimated. The statistics of Beinton and of Welch, still so frequently quoted, are twenty to forty years old; and records of the dead house, as has been learned from the researches of the surgeon, the antemortem pathologist, are no longer of unimpeachable authority.

The time is past when any physician is contented to diagnose a disease by naming one of its most prominent symptoms. As well diagnose appendicitis, "Pain in the belly," as diagnose some gastric lesion "Indigestion." If there is indigestion of one kind or another there must be some cause for it, and we can no longer be satisfied with calling the disorder functional, when to every rational mind a functional derangement is but an expression of organic or structural change. Even hysteria, it seems to me, if it be a disease entity, must have organic changes as its cause, whether such changes are at present appreciable by human sense or not. And so it may be given as a postulate that if there is indigestion there must be a cause for it, and if the indigestion resists the action of diet and rational therapeutics, there must be an organic cause for it; and to remove an organic or mechanical cause, mechanical means are required.

In chronic indigestion, however, mere correction of the diet very frequently fails to restore the gastric functions to the normal condition; and although a certain amount of comfort may be thus obtained, and although the degree of comfort is oftentimes very materially increased by the administration of drugs, it is fatuous to think that in this manner structural changes can be overcome, which have been in existence for many months, nay perhaps for several years. It is quite as logical to expect strychnin to sew up the burst artery in a case of cerebral hemiplegia, as to expect all the pepsin manufactured from all the calves that ever existed since the days of the Garden of Eden, to overcome and release pyloric stenosis, perigastric adhesions or other distortions in the region of the upper abdomen. And, therefore, we reach the conclusion that medical treatment can-

not cure, although it may relieve the symptoms of permanent structural change.

It is a fact, indeed, that most advanced physicians and surgeons are in accord as to the diseases of the stomach, which belong to their respective spheres and there is really no controversy at the present day upon the main points involved. The physician, it seems to me, is in these diseases of value mainly as a diagnostician. With his stomach tube, his test meals, his inflations and percussions of the stomach, he may reach certain valuable conclusions which will confirm the symptomatology of the case, and render positive a diagnosis already tentatively proposed. The physician, however, has been prone to keep his patients under observation, trying first one plan of treatment and then another, without having any very clear idea of the lesions present, and without basing his treatment on any rational physiologic or therapeutic laws. And when the physician became at last convinced that the only hope of cure existed (and that one perhaps very remote) in the form of a surgical operation, he then turned over to the surgeon a patient who was already nearly moribund, saying to his surgical confrere: "Here's your chance; perform one of your brilliant operations on this patient, who has been starving to death under my care, and see if you can restore him to his former health as you are claiming to do." If such a patient is operated on by the too-little conservative surgeon, and does not survive the operation, the physicians in the case wag their heads together, and resolve that they will hereafter let their patients die a natural death, without the terror and discomfort of an operation.

What the surgeon at the present day is asking, and what the enlightened physicians are granting him, is to be called into consultation not only when the physician has made up his mind that further medical treatment is useless, but at a much earlier stage of the disease, that the surgeon may have an opportunity to discuss the surgical aspects of the case with the physician, and to determine not merely whether surgery can be of any avail, but at what moment an operation shall be undertaken to give the best results.

But while I am thus insistent in urging early surgical consultation in cases such as these, I well recognize the fact that every patient will not be a suitable subject for operation, and that a suitable operation is not always applicable. A patient well advanced in years who can keep fairly comfortable by medical means, such as restriction of diet, stomach lavage and the administration of appropriate

drugs, is very likely to be better off under such treatment, and will probably be wiser to continue in it, than he would be to submit to the risk of an operation, which in any particular case might be peculiarly great. The condition of a patient's other organs, his heart, lungs, kidneys, and his general arterial system, must all be taken into consideration; but my plea is that the surgeon and not the physician, should be asked to make the decision for or against an operation. No modern surgeon worthy of the name is content to be relegated to the position of the barber-surgeon of yore, who stood submissively by and acted as a mere mechanical appliance in the hands of the lordly physician, as this latter from the fulness of his knowledge ordered his menial attendant to bleed the patient or to stop the blood-letting for a disease of which the barber understood nothing, and to produce a result about which he cared less.

The objects for which a surgeon operates in cases of gastric indigestion may be classed under the following headings: (1) Rest, (2) drainage, (3) prevention of carcinoma, (4) removal of carcinoma and (5) euthanasia.

(1) REST is the main therapeutic indication in cases of gastric ulcer without pyloric stenosis or dilation of the stomach. The symptomatology of this condition is beyond the province of my paper tonight; but I may say in passing that it is usually for the relief of hemorrhage that the surgeon is consulted in cases of this kind. The bleeding is usually not great in amount at any one time, but by its persistence, and because it is often undetected it gradually saps away the patient's strength; and is hence even more of a menace to life than is the profuse bleeding of an acute ulcer.

When a physician seeks to put the ulcerated stomach at rest, the chief means at his disposal is the abolition, either partial or total, of mouth feeding. Meanwhile the patient is given nutrient enemata. Now while nutrient enemata are a means of treatment whose value is thoroughly appreciated by the surgeon, it is one whose value is very often overestimated. The painstaking research of Edsall and Miller[1] within the last few years have shown that, even under the best conditions, patients fed only by nutritive enemata are slowly starving to death, inasmuch as the rate of elimination always exceeds that of absorption. If this is not the only means by which nutriment is administered, if the stomach receives its quota, however small, then the full-

[1]Trans. Coll. Phys., Phila., 1902, XXIV, 225.

est measure of rest is not attained, since every particle of chyme received into the stomach must pass out of it again by way of the ulcerated pyloric portion. Yet that patients who receive some food by the mouth do not do so badly as those who are prohibited entirely from this means of nutrition is shown by the familiar statistics of Greenough and Joslin.

Now what does surgery propose as a means to secure rest for such gastric lesions? Her plan is to short-circuit the ingested food, so that when it is received into the stomach it passes directly into the jejunum by an artificial opening, and never comes into contact with the ulcerated pyloric area. In surgical treatment, moreover, mouth feeding is now begun within twelve or twenty-four hours of the operation, and at the end of a week a fairly liberal diet may be allowed. On the contrary, after over a week of absolute starvation (the average time in Greenough and Joslin's cases during which patients were on nutrient enemata alone was 8.39 days!) after over a week, I repeat, of starvation, patients treated by medical measures are then only able to increase their diet with great probability of relapse. For, as pointed out by Mayo Robson and Moynihan[2], the ulcer in the stomach is like an ulcer on the leg; as soon as it commences to heal, the pain ceases. Now in medical treatment it is almost impossible to make the patients willing to continue their guarded diet and other remedial measures when once the pain has ceased; and as the cessation of pain by no means implies cure of the ulcer, relapses are frequent.

If the theory then, of the surgical treatment is better than that of the medical, how about the practice? What do the physicians accomplish by medical treatment in cases of chronic gastric ulcer, and what has surgery done?

In this, as in every question of treatment, we have both the immediate and remote results to consider; both the recoveries (from medical treatment or from operation) and the cures. Most strictly medical treatises are discreetly silent as to the immediate mortality under medical treatment. Mayo Robinson and Moynihan, in 1904, stated that under medical treatment the mortality was from 20 to 50 per cent.

Now the average death rate for gastroenterostomy or Finney's pyloroplasty, which are the operations most frequently employed in these conditions, is as low in the average at the present day, in the

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[2]Surgical Treatment of Diseases of the Stomach, N. Y., 1904, p. 177.

hands of competent surgeons as 5 per cent. Among the last forty gastroenterostomies which I have myself performed, there has been only one death or a mortality of 2.5 per cent. It must be remembered moreover, that the figures for the surgical side of the argument include not only operations done to procure rest to the stomach, but also many operations done on stomachs very extensively diseased, dilated, distorted or contracted by chronic ulceration; and that the operative mortality is constantly lessening as surgeons become more expert, and as their experience increases.

In regard to the cures, a decision in figures is not so easily reached. Few series of cases have been followed sufficiently long to give us any accurate data; and the figures which are available apply more especially to the results of operation performed upon patients with pyloric stenosis than upon those in which there is no such obstruction. The figures for the former class of cases will be considered presently, and as such patients are usually more seriously ill than those without pyloric stenosis it is reasonable to conclude that the end results of operation for nonobstructing ulcer are even more satisfactory than are those of operations undertaken for gastrectasis and allied conditions.

The argument, then, for surgical intervention in cases of gastric disease where the indication is rest for the stomach, and where medical measures fail to secure the requisite results, is founded on safe premises, and justifies our conclusion that when medical means fail, resort should be had to surgical operation.

Doubtless some medical man will reply that in persistent nonobstructing gastric ulcers, where medical measures have failed, and where operation has been tried, he has known recurrence of symptoms to occur; and hence is skeptical as to the benefits to be derived from operation. Mumford and Stone, among others, call attention to this fact, and record four such cases, subjected to operation for slight degrees of pyloric stenosis. But they go on to point out that the operation done was a simple gastroenterostomy with a long loop, and that symptoms recurred because the technique was faulty. Immediately after the operation the pyloric irritation subsided, because the food was diverted from its former channel into the gastrointestinal anastomosis. But when the pylorus had regained more or less its normal state, the food again passed through it, this being the easiest and most natural channel to pursue, with the result that the gastrointestinal anastomosis contracted, and the pylorus again became ulcerated. If in such

cases the pylorus had been permanently occluded at the operation, of if Finney's operation had been done, the cure would have been permanent. These are faults which we have learned within the last two years, and we no longer will allow such a series of events to occur. Among my own gastroenterostomies, two suffered from regurgitant vomiting and recurring symptoms. I again opened the abdomens of these patients, and tied off the pylorus, with the happiest results.

Now I would not be misunderstood as urging surgical intervention to procure gastric rest in every case of ulcer of the stomach. Acute peptic ulcers are frequently cured by medical means, and by therapeusis founded on the well-known physiologic laws elaborated by Pawlow. But it is at times very difficult to be certain whether an ulcer of the stomach is acute or chronic. In certain instances, of course, there can be no manner of doubt that the ulcer is acute; but in other cases there may arise symptoms which are quite as acute, yet which nevertheless are due to an exacerbation of chronic ulceration. Naturally, perforation of a gastric ulcer is, on all hands, acknowledged to be a surgical disease; but in the matter of acute hemorrhage there is still dispute. My own view is that it is pure madness to operate while the bleeding is actually taking place, with any idea of finding the bleeding point and ligating it. Such bleeding is almost invariably venous and as invariably very successfully checked by medical treatment combined with absolute rest and the local application of ice. This is the hemorrhage, as Mumford says, which comes as our first intimation that ulcer is present. But the truly alarming hemorrhages, though they are seldom large in amount at any one time, are those which occur in chronic ulceration, and which are dangerous because so often undetected, and because they sap away the life of the patient by unappreciable degrees, maintaining and even, possibly, originating that anemia which is characteristic of the disease. Such occult hemorrhage is of the greatest moment, and investigators who periodically call attention to the subject, deserve the surgeon's warmest thanks. When such occult hemorrhage is prolonged, and recurs persistently if without regularity, operation should be done, and a cure is to be expected. When the hemorrhage is greater in amount, gastroenterostomy should also be done, to allow the ulcer to heal. It is useless to attempt to find or excise the ulcer, gastroenterostomy is sufficient. But recurrence of symptoms must be provided against, either by making the gastroenteric anastomosis amply large, by excising the mucous membrane at the site of the anastomosis; by constricting the py-

lorus, or by employing Finney's operation of gastropyloroduodenostomy. I have tried the last named procedure in a small number of cases, but not with any notable success. It is but just to add, however, that in the hands of its originator as well as in those of several other surgeons of experience, it is a method which has been proved to have distinct value in patients such as those now under discussion.

(2) DRAINAGE.—This is the second object of surgical intervention to which I have alluded. This is indicated in practically every case of pyloric obstruction, a state which is most frequently caused by chronic ulcer. There are very few cases indeed in which the primary gastric hypertrophy which is believed to occur, persists long enough, or reaches such proportions as to be self-curative. Sooner or later the stomach dilates, and like the dilated bladder in prostatic obstruction, the condition becomes steadily worse. The products of the chronic gastric catarrh, added to the natural secretion of the stomach, and the stagnating ingested food, all tend to continue and to increase the dilation. We hear at times of an atonic dilation. I have never myself seen such a condition, and have a very strong suspicion that careful search in such cases would demonstrate the presence of old cicatrices or adhesions, causing a narrowing of the pylorus and hence producing the gastrectasis.

What does medical treatment offer for the condition of gastric dilation due to pyloric stenosis? Gastric lavage, and a carefully regulated diet may keep some patients in comparative comfort; but proper nourishment is not received; the patients are constantly thirsty; they gradually lose weight.

The argument for timely surgical intervention as the best means of preventing carcinoma will occupy us presently, but just now I want to call your attention again to the reasonableness of surgical operation for the relief of gastrectasis and other distortions of the stomach for which drainage is the proper treatment. In this category are included, besides simple gastric dilation from pyloric stenosis due to ulcer, the various forms of hour-glass constriction of the stomach and the distortions caused by extraneous adhesions, whether due to gastric ulcer or to biliary or pancreatic inflammations. Gastroptosis I have never observed unassociated with dilation of the stomach, unless it was in those rare instances of splanchnoptosis in which all the abdominal viscera were prolapsed. When accompanied by gastrectasis it is the latter condition that is responsible for the symptoms, whether the dilation be caused by kinking of the pylorus through relative short-

ening of the gastrohepatic ligament, or produced by coincident but independent ulceration. The proper treatment here, as in other cases of gastrectasis, is some form of drainage operation. I do not favor the operation advocated by Beyea, shortening of the lesser omentum, both because of the danger of wounding important nutrient bloodvessels, and also because, though the malposition of the stomach may possibly be relieved, the dilation is not affected, but may increase and give rise to recurrence of symptoms.

Gastric tetany is a condition whose surgical aspects have been forcibly brought before the profession by Robson and Moynihan. According to these authors dilation of the stomach is almost invariably the cause, and, when this condition is relieved by operation, a cure nearly invariably results. I have not myself had any experience with this condition, but in view of the admitted inefficacy of purely medical treatment, I would not hesitate to recommend operation to such patients should they come under my care.

As has been already pointed out, the mortality of operation for these conditions averages about 5 per cent.; while under medical treatment the immediate mortality is 18 or 20 per cent. and the permanent cures few and far between.

(3) The third object of surgical intervention to which I have alluded is the *prevention of the development of carcinoma* in the stomach. As has been well said, the time to operate to cure gastric carcinoma is while the disease is still in the stage of chronic nonmalignant ulceration. I am sure there is no longer any doubt in the minds of most living pathologists, that gastric carcinoma most frequently is developed from a preceding ulceration with chronic irritation of the ulcerating surface.

If chronic and rebellious cases of gastric indigestion were promptly turned over to the surgeon, and if suitable operations were done on such patients, it is my belief that there would be many fewer cases of carcinoma of the stomach observed by physicians.

(4) The problem of the surgical treatment of lesions which are already carcinomatous in nature, is one which requires the most careful thought. Medical treatment is here even more helpless in affecting a cure than in the chronic diseases of the stomach which have already been discussed. Has there ever been a case of carcinoma of the stomach cured with medicine? Is surgery any less helpless? I think the truthful answer may be in the affirmative, although the outlook here is by no means so bright as in nonmalignant conditions.

Patients with gastric carcinomata who remain untreated, or (which amounts practically to the same thing as far as cure of the disease is concerned), or, I repeat, those who are under medical treatment alone, have an average duration of life, according to Mikulicz and Kronlein[3] of about twelve months from the beginning of the disease. Many writers put it at less. Not only is this the duration of life, but it should not be forgotten that at the end of that time the patients under medical treatment will *all* be *dead*. If then, the surgeon can show any permanent cures, and if the average duration of life under surgical treatment is longer, or at least not less than that under medical treatment, the conclusion is surely irresistible that surgical intervention is best for these patients.

I recognize the fact that occasionally when a surgeon undertakes an operation for a supposedly benign condition, he may happen upon one which is undoubtedly carcinomatous, but one which may not yet be so far advanced as to contraindicate the radical removal of the growth. But these cases are rare; and it so frequently happens that very suspicious looking indurations melt away and disappear after the simple operation of gastroenterostomy, that I should have to be very certain that the growth was really carcinomatous before I would be willing to undertake its excision. And not only should I have to be thoroughly convinced of its malignancy, but I should also wish to be thoroughly sure that the expectation of life in my patient would be increased by the radical operation; that he would live longer and in greater comfort, after a partial gastrectomy than after a gastroenterostomy. Although I have no figures from my own cases to offer you at present, not having traced my patients since operation for malignant disease, I do know that the patients on whom I have done partial gastrectomy for carcinoma have lived in the average a longer time than have those on whom I have been content to perform gastroenterostomy. Other surgeons have recorded better results from the radical operation than the palliative. As a result of my experience I personally believe that the mortality of gastroenterostomy is but little, if any higher, than pylorectomy or partial gastrectomy if the operation is done with dispatch and a perfect technique

But to my mind gastroenterterostomy is the treatment of choice for patients with advanced gastric carcinoma; nor do I limit it to cases

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[3]Mikulicz and Kronlein-Moynihan; Abdominal Operations, Phila., 1905, 223.

in which pyloric obstruction is present. Even if marked stagnation of food does not exist, there can, I think, be no question that direct drainage of the stomach is beneficial, and that by diverting the chyme from its course over the ulcerating area, we check to an appreciable degree not only the pain from the growth but the progress of the malady as well.

If the disease has not extensively involved the stomach, but yet is so far advanced as to contraindicate removal of the growth, I employ the usual operation of posterior gastroenterostomy. If, on the other hand, the disease has progressed further, so as to considerably debilitate the patient, or if there are extensive adhesions, especially to the pancreas, I do simply an anterior gastroenterostomy with the Murphy button. This is a simpler operation, consumes less time, and gives, I believe, equally good results for such patients, who can scarcely ever anticipate a return to normal diet and active life.

(5) OPERATION TO INDUCE EUTHANASIA. Can surgery do anything rational to render less miserable the declining days of a patient who is slowly starving to death from an inoperable carcinoma of the stomach? In my own mind there is no manner of doubt that jejunostomy is frequently an imperative operation. It is true we do but substitute one form of death for another. But, I think there are few patients and possibly fewer surgeons who would not prefer death to come from cachexia rather than from starvation. I believe that the profession in general does not appreciate the degree of alleviation of suffering which these procedures, gastrostomy and jejunostomy, afford. They are operations which may be done under local anesthesia if desirable; but, as a rule, so short a time is required for their performance that a few whiffs of ether will suffice, and will serve merely to stimulate, not to depress the circulation.

In conclusion, I desire to say that the problems of the proper treatment of gastric diseases can only be worked out by the physician and surgeon together. Many, very many cases of chronic gastric indigestion are really a form of surgical disease; and those which do not yield within a reasonable time to rational medical treatment, can almost without exception be promptly and permanently cured by surgery. The fact above all others which I have tried to emphasize is that the surgeon is asking to be called earlier into consultation, that he may decide with the aid of his medical colleague not only which are proper cases for surgical treatment, but also at what period of the disease surgical remedies had best be applied. Both physician and sur-

geon are working conscientiously for the best welfare of their patients, and if the surgical side of the question has through this paper acquired greater merit in the minds of my medical confreres, its purpose will have been fulfilled.

DISCUSSION.

DR. JOSEPH SAILER: I think that the old battle between the surgeons and physicians is really more of a myth than a reality. There are a great many reasons why ulcer cases are not turned over promptly to the surgeon. Unfortunately the internal man does not always see ulcer in the early stage, and the patient may refuse operation.

The more interesting phase of the discussion is the operative treatment of gastric conditions which are neither ulcer, persistent stenosis of the pylorus or carcinoma. There are certain cases of extreme gastrectasis with atony and of hyperchlorhydria in which medical measures are of no avail. It has been suggested of late by various authorities that operation in these cases might give relief. Very frequently cases indicate that we have a spasmodic condition of the pylorus which causes stagnation of food and all the miseries attendant upon that condition. It has only happened to me 4 times in my experience to have referred such cases to the surgeon. One case developed the vicious circle and died of cachexia, although a secondary enteroenterostomy was done. It is very humiliating to the medical man to have a patient die within a few weeks obviously as the result of the operation. Another case is excluded because it was one of extreme gastrectasis and gastroptosis. In two other cases the medical treatment had been carried on for a considerable time and no relief afforded. In the first case the operation was an ordinary Mikulicz pyloroplasty. My personal feeling is that surgeons will employ this operation more frequently in the future than they have in the recent past as a result of the influence of Moynihan. Theoretically, it gives the best physiologic result of any operation on the stomach. In this case the physiologic effect was successful and the patient apparently has been permanently cured. Although he had been in a miserable state of health for years before, he is now able to work and study and has become a useful member of society.

Another patient had the ordinary gastrojejunostomy with the short loop. There had been marked retention with hyperacidity. I have examined the stomach 3 times since the operation and neither of these conditions exist, and so far as the physiology of the stomach is concerned the result is excellent. There was at the last examination a considerable admixture of bile in the stomach contents, which caused a certain amount of nausea, and now, 6 months after the operation, there is a partial vicious circle. The neurasthenic symptoms, moreover, have not been in the least improved, so that the operation cannot be regarded as wholly successful. I think that when we know a little more about the physiology of the stomach, we will be able more certainly to indicate which cases offer the best hope for surgical intervention. I do not think

that upon the failure of medical treatment, surgical intervention is always indicated. It has been my misfortune to see several cases die as the result of operation or to suffer afterwards with increase of symptoms.

Dr. J. Dutton Steele: I would like to call attention to the increasing attention and importance being laid upon the physics of the stomach. I believe that within the next 10 years, following the researches of men like Cannon, of Boston, we shall learn to lay more emphasis upon the motor sufficiency than upon the gastric secretion and then our methods will have to include some such operation, as that suggested by Dr. Sailer, to determine the minor grade of motor insufficiency that we connot determine by the customary methods.

I wish the surgeons would not only give us the mortality and speak of the patients as improved, but tell us exactly how they are in 4 or 5 years after pyloroplasty or gastroenterostomy; whether, as Dr. Sailer says, they remain comfortable. Some have neurasthenic symptoms, which we hoped the operation would relieve. Personally I would not hesitate in turning over to the surgeon any case in which I could demonstrate structural change. I should like to be sure of the diagnosis but upon finding structural change I would be glad to call in the surgeon to avoid the long and weary months of treatment which so often follow in such cases.

DR. DEAVER: I constantly operate upon cases of carcinoma of the stomach because they have not been diagnosed. If the medical man would only see our patients with us and study the living pathology, I am sure he would appreciate the importance of earlier consultations. If I know anything about appendicitis, and I may say the more I see of it, the less I think I do know, it is what I have learned by opening the abdominal cavity in the living subject. I see various classes of cases, but I can never tell exactly the character of the case until I have opened the abdomen. The medical man certainly holds the same position in stomach work that the surgeon originally held in appendiceal work.

Dr. Sailer speaks of patients refusing operations; this is not my experience, but to the contrary, many patients who are too far advanced for operations are greatly disappointed when told that operative interference would not be advisable. Regarding the vicious circle, it is well known that a small percentage of patients die on this account, the mistake that is made in this class of cases is in not reoperating early enough. I consider pyloroplasty an unsatisfactory operation, as a rule; only today I saw a lady upon whom I did this operation last winter and she now has a return of the old symptoms, I purpose, therefore, doing a posterior gastroenterostomy. If gastroenterostomy is properly done, the opening is brought to the lowest level of the stomach and thorough drainage is accomplished. An open pylorus with practically normal stomach motility in the presence of a gastroenterostomy opening calls for tying off the pylorus, otherwise a vicious circle is liable to occur.

Dr. Steele asked about patients 3 or 4 years after pyloroplasty or

gastroenterostomy. I tried to point out in my paper by the cases that have been followed up that they were perfectly comfortable. In the cases I have had to reoperate upon I have never seen but one perish. At one time I had 2 cases of vicious circle upon which I reoperated, using the long loop. One got well promptly; the other had a perforative peritonitis; too large a button was used and the result was bad, because the surgery was bad. The consensus of opinion among surgeons is that the best possible operation is the short loop. I have since been doing this operation but have not had a sufficient number, to say that I may not have vicious circle.

In regard to gastrectomy, it is astonishing how little shocked the patient is, if the operation is done in a short time. This was brought out this week in a patient in whom I removed the greater part of the stomach. There was a hugely distended gall bladder and an adherent omentum. I believe the gallstones were in all probability responsible for the carcinoma, they giving rise to the gastric catarrh, which resulted in carcinoma. I emptied the gall bladder and removed a stone from the common duct, draining both. I then did a partial gastrectomy; the patient is doing well. This case demonstrates that partial gastrectomy cannot be the very formidable precedure that many think it.

Some Symptoms in Childhood Suggestive of Congenital Syphilis.

BY ALFRED HAND, JR., M.D.

[Read November 22.]

It is not my purpose to take up your time with an exhaustive discussion of all of the effects which syphilis in the parents may have on the offspring, for the subject is treated systematically in the text-books. Using a few cases that have recently come under my observation, I wish to call attention to the necessity of bearing this disease always in mind, no matter what the surroundings of the patient may be, and to be on guard for its unusual appearances.

The lesions of an eruption appearing shortly after birth, periostitis, interstitial keratitis and Hutchinson's teeth are all well-known and are easily recognized. A more difficult problem is to decide whether such symptoms as eruptions appearing after the first year of life, malnutrition in infants, anemia and many other lesions are of the so-called specific origin. It is in this class of disorders that the diagnosis does not often go beyond the realm of possibility, sometimes is in the realm of probability and occasionally is in the realm of certainty. Even when it is strengthened by an apparently positive

therapeutic test we must not be too eager to fix it in the last division, that of certainty, as will be illustrated, I believe, by the accompanying notes of cases.

Case 1. ERUPTION, ANEMIA.—B. M., male, came first under my care as a decidedly marasmic infant, nearly 3 months of age, weighing 6½ pounds, or 5½ pounds under the average weight. The father was a travelling man and this was the first child in 13 years of married life, but there had been no miscarriages or any other symptoms that could be elicited pointing to syphilis. The malnutrition of the infant certainly did not depend on syphilis, or rather a rational explanation of it was found in the irrational way in which he had been fed. I have detailed elsewhere (*Internat. Med. Mag.*, August, 1903.) the notes in this case from the feeding standpoint and only exhibit the weight-chart to show the results. Further events in his history were whooping cough in his second winter, followed in his second summer by a moderately severe enteritis, this, however, being associated with a profound anemia which a stay of several months at the seashore did not remove. On his return in the autumn the hemoglobin ranged from 30 per cent. to 35 per cent. Fleischl for several months, in spite of all that was done hygienically and medicinally to bring it up to par. After a time a brownish, macular eruption appeared over the buttocks and perineum, attended with considerable scaling but without marked itching. Treating it as an eczema for 2 weeks produced no improvement, when a change was made to the ointment of ammoniated mercury locally, and corrosive sublimate was given internally, 1/60 grain 3 times a day. The rash disappeared rapidly and the hemoglobin rose by leaps and bounds in spite of the winter months and the necessary housing of the child. Mixed treatment was employed subsequently for a time, but the main reliance through last winter was on cod-liver oil, the child at my last visit being an apparently healthy 2½-year old specimen.

I would not presume to make a positive diagnosis of syphilis in this case or to exclude it positively. Too many nonspecific eruptions are removed by ammoniated mercury to attach much weight to that point, and mercury bichloride is well known as a good hematic, but the anemia had this curious feature that although it was started secondarily to an acute enteritis, (and such profound anemia is not a common complication of diarrhea) yet it did not disappear when the digestive organs became normal and it did not yield to various iron preparations, but did so with unusual rapidity under mercury.

Case 2. MALNUTRITION, HUTCHINSON'S TEETH.—D. G. is an undersized girl, 8 years old, who, as an infant was a difficult feeding case under the care of another physician. She has obstinate constipation, is thin, shows signs of having had marked rachitis and is subject to frequent attacks of bronchitis and digestive disturbances. Mentally she is precocious to the

degree attained only by an only child. For several years I endeavored with indifferent success to relieve her mother of prolonged attacks of dull headache, which would recur with discouraging persistency; there had been malaria and heat prostration in previous years and all through the infancy of her child the night's rest had been disturbed; treatment along lines suggested by these data did not seem to be of great value, nor did careful search by specialists reveal any ocular, nasal or pelvic sources for reflex disturbance. Twenty months ago the mother had several intestinal hemorrhages, the first of which followed a fall; but later ones seemed causeless as there were no hemorrhoids. The suspicion of a gummatous ulcer of the large intestine and the thought that the headaches might be of specific nature led to the use of increasing doses of potassium iodid and there have been no more headaches or hemorrhages for 18 months. This suspicion received considerable confirmation a year ago when I happened to see the daughter for a grippal attack and in looking at the throat observed the permanent incisors which, not having attained their complete prominence, were isolated and the free margin was notched, the appearance being strongly suggestive of Hutchinson's teeth. The mother saw me looking at the teeth and asked what could be done for them as they were so disfiguring. I saw the child recently and the other permanent teeth have crowded the central incisors together and their cutting edges have been worn away more nearly straight, so that the resemblance to the typical Hutchinson's teeth is disappearing but can still be seen.

Looking backward with the knowledge of these facts, the thought arises that the malnutrition during infancy may have been due in part at least to a constitutional syphilitic taint. Even in this case we must not be too dogmatic, for competent observers (Keyes) hold that Hutchinson's teeth may be caused by malnutrition in infancy without syphilitic taint. On the other hand, the fact that the teeth at present are losing their resemblance does not militate against their being genuine Hutchinson's teeth, for spyhilitic teeth are not always diagrammatically typical.

Case 3. BACKWARDNESS, DEAFNESS, SUPPURATIVE PERIOSTITIS.—H. P., male, present age 7 years, has a family history of tuberculosis, the father having an anchylosed hip joint from coxalgia in childhood, and the boy's mother died 3½ years ago of lung trouble, having been sick for some time. When he was a year old he had a light attack of scarlet fever, complicated by an otitis with a discharge for a short time. Shortly after this swellings appeared on the extremities, without heat or redness, and softening followed with the formation of sinuses. When I first saw the boy he was nearly 2 years old, frail and anemic, with sinuses in the right foot, the left hand, the right elbow and subsequently over the left horizontal ramus of the lower jaw; these sinuses discharged a thin pus and were accompanied, as well as preceded, by great induration of the surrounding

tissues; dead bone could not be felt with a probe, nor was any noticeable in the discharge. At first I looked on the lesions as tuberculous, but a surgeon who saw the case with me suggested the possibility of syphilis and it was deemed advisable to treat it accordingly. The official ointment of mercury was used over the indurated area, with potassium iodid internally in large doses; later syrup of iron iodid was used with benefit. After 4 months, healing was complete with total subsidence of the swellings and very little scarring.

The boy did not walk until his fourth year nor talk until his sixth year, but the backwardness with regard to walking might be explained by the general weakness and by the impediment offered by the bandages. The slowness in learning to talk may also have been partly due to the deafness, which may have been due to the scarlatinal otitis or it may have depended on a gumma, but his hearing is now good for ordinary conversation, so it was evidently not of the type sometimes seen in syphilitic children which comes on suddenly and is not benefitted by treatment. The permanent teeth have begun to appear and are normal, but this does not exclude congenital syphilis as every one will doubtless admit.

This case may have been merely one of so-called scarlatinal rheumatism, although the joints were not involved, but with the suspicion of syphilis once raised it is difficult to exclude it.

Case 4. MALNUTRITION, LATE ERUPTION.—V. H., female, 3 years old, was breastfed by her mother for 24 hours after birth and then fed by a wet-nurse for 8 months; when weaned her nutrition was only fair, signs of rachitis on the parietal bones and ribs being slight, the flesh being a little flabby, but dentition having begun. After the weaning she was given modified milk (Gärtner's *Fettmilch*), which was boiled, and constipation became troublesome. She came under my care a year ago, when 2 years of age, for general debility; some of the ways in which this was manifest were lassitude, the child being content to sit quietly all day long instead of romping; a general fragility of structure, so that whoever lifted her feared that she would fall apart; a frequent tendency of the rectum to prolapse with the bowel movements; numerous colds, one of which spread to the middle ear with a long, purulent discharge; and attacks of apnea differing from laryngismus stridulus in not having the violent contractions of the diaphragm nor ending in the crowing inspiration. These attacks usually came on at the end of a crying spell, with a mottled congestion of the face which rapidly became pale and remained so for some time after respiration was restored; dashing cold water in the face shortened the attack, but if this was not done the duration would be from 1 to 1½ minutes. I have looked on these attacks as a combination of a neurosis and cardiac syncope, the heart being embarrassed by the strain of crying and a faint resulting. (The possibility of epilepsy

seems very remote, although one attack since the reading of this paper was accompanied by twitching of the legs). The parents had separated, the mother having reason to suspect the father of infidelity, but there were no special facts, such as miscarriages, to be elicited, pointing to parental syphilis. The mother suffers at times from severe headaches, but she is an inveterate drinker of tea and coffee, has marked ocular defects, including nystagmus, and she had these headaches previous to her marriage. Shortly after marriage 2 children were born who are robust, and then there was an interval of 6 years before the birth of this child. The mother gives no history of any syphilitic manifestations if we except an eczema after the birth of the last child; this eruption, according to her description, consisted of red spots limited to the face and neck and lasting for 4 months, during which time her physician treated it solely by salves locally. When I first saw the child a year ago there were no congenital manifestations beyond a suspicion of rhagades around the sphincter ani, but judgment was suspended on these owing to the relaxed condition of the parts and their frequent stretching by the prolapses of the rectum. Recently there appeared a papular eruption on the forearms and hands, discrete, small, 2 mm. in diameter, and of a reddish-brown hue, a few lesions being on the palms of the hands. The distribution suggested mosquito bites, so specific medication was withheld for 2 weeks, when there appeared suddenly over the buttocks a papular eruption with a few vesicles which rapidly became papules, coppery in color, 3 to 4 mm. in diameter; these were numerous and extended over the buttocks and well down onto the thighs. Itching was slight. Mercurial ointment was applied and large doses of iodids given and tolerated, with apparent benefit as the eruption has disappeared and the child's general condition is as good as it has ever been, although there is a tendency to a return of the syncopal attacks which occurred frequently last winter, but nearly ceased during the summer.

These cases are not advanced as clean-cut cases of syphilitic infection, but they serve well to illustrate the conditions which confront us in practice, and if they are syphilitic, they also show how varied the phases of this disease may be.

It is interesting to speculate on the reason for such comparatively slight symptoms as the above, if they are syphilis, and this is a question which bids fair to be settled soon, if the spirocheta pallida is found to bear a causal relation to the disease. It is possible that the germ transmitted to the fetus may have been so affected by specific treatment in the parent as to be incapable of doing damage in the offspring.

SYMPOSIUM ON ARTERIOSCLEROSIS.

[December 13.]

Arteriosclerosis as a General Disease.

BY ALFRED STENGEL, M.D.

It is noteworthy that there remains so much that is obscure and uncertain about arteriosclerosis when one considers the amount of investigation that has been devoted to it and the seemingly satisfactory conclusions that have been reached in certain directions. The recognition of arterial disease as a factor in certain organic conditions, such as cerebral hemorrhage, myocardial disease, focal necroses, gangrene, aneurism and some other localized processes, seemed to have established a quite comprehensive understanding of the pathologic importance of the condition until Gull and Sutton and Lancereaux showed the much broader relations of the condition and opened up a field for investigation both clinical and pathologic far more extensive and difficult. The conception of arteriosclerosis as a process of hardening of the vessels, which may or may not occasion serious embarrassment of the circulation and secondary results due to cardiac failure, thrombosis, embolism or rupture of the vessels—this older conception is now completely out of date. A proper picture of the condition portrays a more general disturbance of the whole organism, a tendency to widespread degeneration of tissues and in the early stages nutritional or metabolic disorders in part the concomitants of the causal conditions and in part the result of the initial stages of the arterial disease. To be a little more specific; it must be recognized that with advancing arteriosclerosis, there is disturbance of organic functions not confined in a strict sense to the circulation, but involving digestion, renal action, various nervous mechanisms, perhaps also the hepatic processes and general metabolism. These are not definitely the results of mechanical disorders of circulation and the moiety dependent upon the underlying causes of the disease cannot be surely distinguished from that which results from the arterial disease itself. I am speaking now of early stages and may illustrate by a striking case that came under my observation recently.

A gentleman, aged about sixty years, who had been accustomed for many years to a generous (that is immoderate) life, who had consumed much alcohol, and who was manifestly gouty, first developed an obstinate form of eczema, then a dry pleurisy, later a dry pericarditis, and finally a condition in which loss of weight, loss of vitality, increasing pallor, disturbances of circulation, slight cardiac pain, dysp-

nea and flatulent dyspepsia were conspicuous. At this time definite hardness of the peripheral vessels was discovered and increasing circulatory disorder followed.

One might in such a case conceive of the pathologic process as simply a form of generalized gout affecting first the skin, next the pleura, then the pericardium and finally the cardiovascular apparatus; but as the trouble advanced, the significance of the arterial element became more and more marked, and the separation of the role of the original cause from that of the secondary process became somewhat difficult though it was evident that each bore a notable part. It is noteworthy that in this case a thoroughgoing regulation of the patient's life and a course of treatment at Nauheim, apparently arrested both processes for a time. Up to the period at which this case had arrived there were no terminal changes in important organs, not even as far as could be discovered, in the heart.

In the middle stages, however, of arteriorsclerosis, widespread organic lesions do occur. The effects of coronary sclerosis in the heart muscle are well known; the frequency of renal sclerosis has been emphasized by Gull and Sutton and many others, the cerebral and even spinal results are familiar though only recently fully recognized; the lungs, the pancreas, the gastrointestinal tract and even the liver, so scantily supplied with arterial circulation, suffer degeneration and atrophic change. It is not my purpose tonight to discuss the relations of the arterial disease to any of these organic changes, nor to estimate the frequency of an arteriosclerotic origin of the organic changes in question. Those who are impressed with the importance of arteriosclerosis as a generalized disorder perhaps overestimate its part in the causation of such diseases, but the profession as a whole undoubtedly fixes its attention too closely upon the conspicuous manifestations presented by the organ that happens to be principally involved. It cannot have escaped the attention of any of us that chronic interstitial nephritis as an independent affection is less frequently discussed than formerly, though the opinion that this particular form of renal disease is nearly always a result of arteriosclerosis is possibly extreme. Doubtless there are occasional cases of primary chronic interstitial nephritis with secondary arteriosclerosis just as there are frequently cases of chronic diffuse nephritis with such a result. Somewhat similarly chronic myocardial disease independent of valvular disease and arteriosclerosis is less frequently recognized than formerly.

In this second period of arteriosclerosis as in the first there is difficulty in recognizing the part of the arterial disease in the general condition, since the secondary organic disorders contribute a more or less indistinguishable portion of the clinical picture.

Finally in the last phase, whatever the type of the case, increasing circulatory disturbances usually dominate the whole process. There are cases of purely renal or cerebral death, but as a rule, even when the type has been cerebral or renal, cardiac failure terminates the scene. It must not be forgotten, however, that in this final stage increasing susceptibility to infection with decreased circulation may occasion terminal infections, especially pulmonary and peripheral. We may then recognize three stages of arteriosclerosis considered as a general disease:

(1) A preliminary one, difficult of recognition in its beginnings and confusing to the clinician in his efforts to distinguish the part of the etiologic factors from that of the arterial disease in the symptom complex.

(2) A middle period during which the arterial disease is easy to recognize, but in which secondary organic changes have a role of variable importance.

(3) A final stage of failure of circulation, organic failure and terminal infections.

The diagnosis of arteriosclerosis is usually established during the second period and rarely offers serious difficulty. Only when undue attention is given to some local disturbance, such as albuminuria, palpitation or vertigo, or when the vascular disease is so uniformily distributed that it manifests itself only in a general failure of vitality, is the recognition of the disease likely to occasion confusion. In the final stages, too, though the form of local disease and the immediate occasion of the patient's failing health, or taking off may be too much considered, the contributory influence of the hardened bloodvessels rarely escapes attention.

So much has been accomplished for the recognition of arteriosclerosis as a general disease and as the foundation for morbid processes of varied type. Only recently, however, has the campaign of investigation been extended to the earlier stages, the period when obscure and less certainly organic vascular conditions present themselves. I recognize the uncertainty of conclusions drawn from such pathologic and clinical investigations as have been made, but it cannot be denied that

a variety of testimony justifies the tendency to regard beginning arteriosclerosis as a general cause for certain obscure forms of disease or disorders of health or vitality.

A clearer view of the conditions of this stage will be obtained after a brief survey of the pathologic features of the disease of the arteries and a reference to some of the etiologic factors. Arterial hardening is one of the factors in the pathology of senility and a greater or less degree may be expected in every human being beyond the age of sixty. How much earlier such changes may occur depends upon various conditions of life. Undoubtedly in many the process begins quite early and progresses so regularly and slowly, and with so little disturbance of circulation or other functions that it long remains unrecognized or even unrecognizable. Quite different from this normally progressive arterial disease is that which is met with in younger subjects. More conspicuous than any other difference is the tendency to restriction of the process to certain localities, or at all events to the greater involvement of certain vessels. In the senile form there is a more uniform process involving the vessels of the center and periphery more or less equally, and with this I believe there is a coincident involution of somewhat the same character involving the body as a whole. It would lead too far to discuss the reasons that seem to me to justify the view that the tissues generally are involved somewhat independently of the arterial narrowing and failing circulation, but I must at least refer to the fact that general sclerotic processes in the organs and their capsules and shrivelling of the tissues are sometimes distinctly out of proportion to the arterial involvement. Whatever may prove to be the truth as to this view, there is no doubt that the symptoms of normal senile arteriosclerosis are strikingly scanty as compared with those encountered in cases of the presenile disease. It may be said in answer that only the cases which proceed in a quiet progressive fashion are classified as normal senile types, but, on the other hand, we cannot but recognize that the cases recognized early are those which are in a majority of instances likely to be attended with marked disturbance of health and with definite organic disease. I have come to the conclusion that the presenile cases are in the matter of their nature as well as their time of occurrence more distinctly pathologic; that by reason of their comparatively greater involvement of the arteries than the tissues as a whole they are more prone to cause notable functional disturbances, and for the same cause are more likely to run a rapid course.

There is still so much uncertainty as to the exact role of laborious work, alcohol, other intoxications, overfeeding, nerve strains, gout, primary renal disease, heredity and infections in the causation of early arteriosclerosis that it is impossible to express certain convictions regarding the existence of a form of arterial disease due to such causes differing from the normal involutional type. But it is of interest to note in this connection how generally certain syphilitic diseases of the arteries are distinguished by pathologists from ordinary arteriosclerosis, a distinction that until quite recently has been regarded as of doubtful significance.

The obscurity of the early changes in the bloodvessels and the uncertainty regarding the part of the vascular system first involved, the clinical difficulty of determining accurately the circulatory conditions of the early stages, and the want of reliable information as to the physical and chemic properties of the blood in the beginning stages have thus far made the study of the origin of arteriosclerosis an unproductive one. Physiologists and clinicians have occupied themselves with determinations of blood pressure and various investigators insist that there is a preliminary stage of continued high blood pressure. This has been attributed by some to spasm of the arterioles or contraction of the capillaries due to toxic or nervous influences, by others to some change in the viscosity of the blood causing obstruction of the circulation. The latter view rests upon hypothesis, pure and simple; the former is based upon observations, which, with von Basch, I believe, have often been conducted in cases of already established arteriosclerosis. Those who maintain either of these views contend for a presclerotic or a preorganic stage of the disease. My own clinical studies in cases that have developed arteriosclerosis under observation have convinced me that in the early stages there is a condition of decreased tension with a tendency to temporary or paroxysmal elevations. In such cases I have not been able to persuade myself that there ever is continued hypertension and I am, therefore, disposed to believe with some pathologists that the earliest condition in arteriosclerosis is one of loss of elasticity in the vessels from changes either in the media or intima, or both, that the changes are initiated by toxic alterations (degeneration) of the vessel walls and not by spasm due to such toxic agents. Beside the reason given (the arterial pressure in developing cases) I would base this view on certain clinical symptoms, such as paroxysmal sweating, variable quantity of urine and temporary and slight edema. Whether, however, there be

spasm or relaxation of the peripheral vessels in the early stages, there are certainly altered conditions of circulation in the peripheral vessels, and in view of the fact that the changes are more or less wide-spread in every organ of the body one readily appreciates that generalized disturbance of function will occur. If one trace back the history of cases of rapidly developed general arteriosclerosis, one will find a gradual development of certain symptoms that indicate such a falling off or perversion in organic function as the postulated conditions would probably occasion. Loss of vitality, decreased resistance to external conditions and a tendency to slight infective ailments, nervous depression, various organic derangements, moderate circulatory disturbances—these are among the early signs of the beginnings of the disease. They may with some probability be referred to the derangement of the intimate circulation of the organs of the body and perhaps to metabolic disorders partly caused by the original cause of the disease and partly by the effects of the vascular disease on organic action.

Among the varieties of early arteriosclerosis, I have observed several more or less distinct types; nurtritional, neurasthenic and nervous.

NUTRITIONAL TYPE.—The cases of this group present more or less obscure disturbance of general health with a tendency to digestive disorders and anemia or pseudoanemia. There may be little loss of weight at first, but in rapidly developing cases emaciation may proceed rather steadily. In some there is the appearance of a causeless progressive deterioration of health; in these cases, a tendency to acute infective diseases in themselves perhaps trifling in character may be conspicuous. I have in mind instances of individuals, who, during the developing period of a presenile arteriosclerosis suffered repeated attacks of laryngitis, bronchitis and other minor ailments of this sort. The impairment of health was out of proportion to the character and severity of the infective disease and probably more dependent on the underlying cause than on the acute incident.

I have elsewhere spoken of the importance of psuedoanemia in the diagnosis of arteriosclerosis. As a rule it is a condition of the more advanced stages, but sometimes makes its appearance rather early. I believe it is more largely the result of contraction of the vascular channels with resulting pallor than of deterioration of the blood.

NEURASTHENIC TYPE.—In some of the cases of beginning arteriosclerosis with or without definite nutritional disorders, the patient presents various evidences of neurasthenia. Perhaps the most striking

instances occur when arteriosclerosis occurs in the fat, but sometimes it becomes progressively more marked as emaciation proceeds. It is of course, difficult to distinguish between the neurasthenic symtoms that may attend a developing arteriosclerosis and such secondary arteriosclerosis as may engraft itself upon a preexisting neurasthenia.

There are no special symptoms that distinguish this type of neurasthenia from others, excepting that circulatory symptoms are perhaps more common.

NERVOUS TYPE.—Besides the neurasthenic variety there are types of arteriosclerosis in which certain nervous symptoms are conspicuous. When the hardening of the vessels is considerably advanced, various central nervous symptoms may be met with, such as temporary paresis, spasmodic or convulsive disorders or disturbances of consciousness. In earlier stages, however, minor symptoms, such as a tendency to vertigo, tinnitus and disturbing sounds in the ears or syncopal attacks, may occur. Peripheral symptoms of the type of claudication are met with in a variety of forms. In a few reported instances, there has been extraordinary muscular weakness, even when collateral circulation had developed quite extensively. Migraine and neuralgic troubles also figure among the minor forms of nervous symptoms in the early stage.

In the more advanced stages arteriosclerosis is easily recognized by the discovery of palpable thickening of the bloodvessels, by the increased vascular tension, by the auscultatory phenomena at the heart, and by the general appearance of the patient. The disease presents itself in a variety of forms or types, according to the special involvement of one or another of the important viscera, or by certain special vascular conditions. I have been in the habit of classifying such cases under the following headings: (1) the thoracic type, of which we may distinguish the (a) cardiac or (b) aortic; (2) the abdominal type, of which there are (a) renal, (b) intestinal, (c) pancreatic and (d) hepatic varieties; (3) the cerebrospinal type, and (4) the arteriocapillary type.

It is unnecessary to discuss each of these at length, but a few words about the more important features may be added to complete the presentation of my subject.

In the cardiac variety there may be moderate disturbances of the heart's action with a tendency to arrhythmia, more pronounced symptoms of myocarditis, or even the symptom-complex, which we designate as angina pectoris. The immediate occasion of these disturbances is doubtless in the majority of cases some special involve-

ment of the coronary vessels. It cannot, however, be denied that without special involvement of these vessels there are sometimes cardiac lesions and symptoms resulting from the general vascular disease and the undue strain placed upon the heart.

By the aortic type I mean not merely those cases which show a tendency to fusiform dilation of the arch or aneurism, but also cases in which without dilation, the arch of the aorta is involved in a marked process of sclerotic and calcareous change and in which there are symptoms of cardiac embarrassment and physical signs indicative of roughness in the lining of the aorta at this point. These cases it is important to recognize as being distinguishable from cases of aortic stenosis with which there is a certain resemblance in their physical signs.

The renal variety manifests more or less markedly the well-known symptoms of chronic interstitial nephritis. In a great majority of cases of advanced arteriosclerosis, slight albuminuria appears from time to time, and hyaline casts are occasionally seen. Only in a minor proportion of the cases do the renal conditions advance to a stage of well defined interstitial nephritis. This sometimes stands out conspicuously while the arteriosclerosis is less evident. On the other hand, in certain cases, it may be at once apparent that the renal disease is but a part of the arteriosclerosis, which is the more pronounced condition.

Intestinal types of arteriosclerosis are less commonly recognized. Atrophy of the mucous membrane, and a tendency to chronic colitis, ulcerations in the upper part of the small intestine and forms of sudden painful obstructions (paresis of the walls) of the bowel are among the more important intestinal conditions.

Pancreatic cirrhosis as a part of general arteriosclerosis is unusual and rarely presents clinical symptoms sufficiently distinctive to make it recognizable during life. In some cases the pancreatic lesion may occasion diabetes.

Hepatic cirrhosis as a consequence of arteriosclerosis is less likely to occur than are sclerotic lesions of other organs, for the reason that the circulation of the liver is so freely anastomotic, and that the artery supplying the liver is comparatively speaking a minor factor in the circulation of the organ. When this disease does exist in association with arteriosclerosis, it is more likely that the same cause had been operative to produce both conditions than that either was a sequence of the other.

Cases of the cerebrospinal type of arteriosclerosis are numerous

and varied in the more advanced stages, when the vessels have become greatly thickened, temporary palsies or aphasia, slight convulsive seizures, suggesting petit mal, and attacks of sudden unconsciousness occur. Probably a number of definite nervous diseases of cerebral causation have as their underlying basis arteriosclerosis of the cerebral vessels. It is impossible to discuss these at the present time.

By the arteriocapillary type, I mean cases in which either in the presenile or the senile period of life, generalized arteriosclerosis occurs without definite local organic involvement, in which in other words the condition of the vessels alone is conspicuous and moderate circulatory disturbances alone call attention to the vascular disease.

Pathology and Diagnosis of Myocardial Inflammations and Degenerations.

BY JUDSON DALAND, M.D.

The comparative importance of myocarditis to other pathologic changes in the heart muscle, steadily diminishes as knowledge increases, and in this respect resembles the progressive changes that have taken place in recent years regarding our concepts of encephalitis. Formerly most of the morbid changes in the myocardium were believed to be inflammatory, but more recent investigations show that most of the more important chronic affections of this muscle are true degenerations. The relation of inflammation to degeneration of the heart is most complex and confusing. Either may exisit independently, or one or the other may precede or follow, or both may occur simultaneously.

A satisfactory classification is difficult, as various lesions merge into one another. Two great groups may be recognized—the inflammations and degenerations—each of which may be acute or chronic, circumscribed or diffuse.

According to Camac, myocardial diseases may be grouped clinically as (1) acute, (2) chronic, (3) systematic, (4) mechanical, all of which may be classified under insufficiency of the heart with or without valve murmur.

MYOCARDITIS may occur as an independent affection or in association with fatty and other degenerations. It may be acute or chronic, circumscribed or diffuse. The intermuscular connective tissue is swollen and infiltrated with small round or spindle-shaped cells and leuko-

cytes. The bloodvessels are dilated and their walls show proliferative thickening. The muscle fibers are usually degenerated and become granular, opaque and lose their striæ. Occasionally, segmentation has been observed. The muscle fibers may undergo fatty, and occasionally the hyaline degeneration of Zenker. Myocarditis may be caused by the toxins of typhus, typhoid fever, scarlet fever, diphtheria, rheumatism, gout, acute, chronic or recurring endo or pericarditis, gonorrhea, malaria, pneumonia, influenza, streptococcus tonsillitis, and may be occasionally provoked by prolonged intestinal toxemia.

SUPPURATIVE INTERSTITIAL MYOCARDITIS or abscess of the heart was first recognized in the fifteenth century by Benivieni. This process may be acute or chronic, and, as it is usually embolic, the abscesses are usually multiple. The most frequent cause is ulcerative endocarditis, although it may be induced by any of the causes that produce pyemia. These abscesses vary in size from a mere point to a small hen's egg. Perforation may take place into one of the cavities of the heart or the pericardial sac, which in turn may be followed by aneurysm, rupture or hemopericardium. As a rule death occurs although rarely the pus becomes inspissated and later encapsulated.

CHRONIC MYOCARDITIS is usually circumscribed, although it may be diffuse, and is induced by the continued action of the causes of acute myocarditis, or as an end result. It is not infrequently observed in arteriosclerosis and endarteritis, especially the obliterating variety due to syphilis. It is frequently combined with myocardial degeneration, and has been described by Huchard as dystrophia-sclerosis. Certain forms of chronic myocarditis have been observed that were primarily periarterial or perivenous in origin.

ACUTE PARENCHYMATOUS DEGENERATION of the myocardium was first described by Virchow as an inflammation. This process is a true degeneration although it occurs in myocarditis. The heart is unusually soft and pale and the entire organ is involved, more especially the left ventricle. Histologically, there is degeneration of the muscle fibers which are finely granular, which granules resist the action of ether, and are dissolved by acetic acid. When the process is well advanced the striæ are invisible. Associated interstitial myocarditis is sometimes observed. This process has been found in typhoid fever, typhus, diphtheria, variola, rheumatism and other infections, the active agent, in all probability, being, a toxin elaborated by these various microorganisms. Osler maintains that there is no etiologic relation between high fevers and this degeneration.

SEGMENTATION AND FRAGMENTATION are regarded by certain authors as artefacts or that the cement substance is dissolved by the action of unknown ferments. This condition, which has been called fragmentary myocarditis, was described by J. Renault, in 1889, and soon after by his pupils Mollard and Lepine, since which time the subject has attracted the attention of many pathologists. In segmentation the muscle fibers are sometimes separated at the cement line, but more frequently near the center, whereas, in fragmentation the fibers are fractured transversely, usually on a level with the nucleus. This condition is extremely common, and according to McFarland, occurs in upwards of 50 per cent. of adult hearts examined.

CHRONIC FIBROID DEGENERATION OF THE MYOCARDIUM OR CARDIOSCLEROSIS has been designated by Huchard as ateriosclerosis of the heart. This condition is usually more or less circumscribed occurring in spots, streaks or lines following the direction of the muscle fibers. This process frequently affects the corni-arteriosi, chordæ tendineæ and papillary muscles. Certain sclerotic areas are due to infarcts. The connective tissue between the muscle layers and bundles is increased, and from pressure and fautly nutrition, the muscle fibers undergo atrophy and fatty degeneration. It occurs as a consequence of certain forms of interstitial myocarditis, arteriosclerosis, endarteritis, acute or chronic endo or pericarditis, chronic passive congestion and in the terminal stage of many of the hypertrophies of the heart. The most important cause of cardiofibrosis is the interference with the coronary circulation from sclerosis or valvular disease, thereby causing malnutrition of the heart muscle by diminishing the blood supply to that organ. The causes of arteriosclerosis are the remote causes of cardiofibrosis.

Four principal views have been held regarding the structures primarily affected in this disease: (1) That it originates as an inflammation of the muscle fibers, and this view, although at first popular, has been discarded; (2) that the interstitial tissue is first involved and that the process is inflammatory, which view was first advanced by Corvisart and accepted by Bristowe in 1842, who called it "Cardiac Cirrhosis;" (3) that the process begins in the vessels as a periarteritis extending by contiguity; (4) Huchard, Weigert, Huber, Zeigler, Leyden and others believe that cardiac cirrhosis is a degeneration of the myocardium due to faulty nutrition, the results of diminished blood supply to the heart muscle, caused by arteriosclerosis.

I am of the opinion that Huchard's view of the pathology of

fibroid degeneration of the myocardium is the correct one, and explains satisfactorily many of the pathologic and clinical conditions observed in this disease.

Sclerosis of the arteries may produce cardiac fibrosis by interfering with circulation: (1) by encroaching upon the lumen of the coronary arteries or their branches; (2) by encroaching upon the orifices of the coronary arteries in the aorta when this vessel is sclerosed; (3) by diminishing or disturbing the balance of the coronary circulation when the sclerosed aortic valve permits regurgitation; (4) by producing hypertrophy of the heart in general arteriosclerosis, which hypertrophy may undergo fibroid degeneration.

When arteriosclerosis is well marked, the myocardium in certain cases preserves a fair degree of functional integrity, provided the coronary suffers no more than the remainder of the arterial system. Rapid thrombosis may cause myocardial malacia and slow thrombosis sclerosis, when these processes occur in cardiac cirrhosis.

The heart may be normal in size, but is more usually enlarged, due to thickening of the walls and dilation of the cavities. It is usually globular or conical in shape due to the greater involvement of the left ventricle, or it may present a bilobed appearance, when the right ventricle is also greatly involved. Its consistency is increased, and the muscle is hard and resistant. The color of the heart is normal, excepting in the sclerotic areas, which are pure gray or yellowish, and are rarely uniform in color and do not resemble the "dead leaf" appearance presented by the myocarditis of acute infection. Fatty degeneration is often present and is variable as to site, intensity and extent, and may follow the vessels or envelop the heart, especially the posterior portion. It is usually more marked in dilated than in hypertrophied hearts. Huchard maintains that the heart is always hypertrophied and dilated and that the former precedes the latter, which is a terminal condition. Section of the heart reveals, in the midst of almost normally colored muscles, sclerotic areas, lattice-like or in bands or star-like points, or elongated or oval islets, which may be discrete or confluent, millet seed or pin-head in size, as large as a grain of corn, or even involving a large part of the walls. The color is mother of pearl, bluish, ashy or gray. The cardiac muscle is slightly elevated about these areas, somewhat resembling microscopic infarcts. In obliterative endarteritis most of the islets of fibroid degeneration are disseminated. These areas are described as adult. The young sclerotic area resembles the adult in form and distribution, but dif-

fers in color, being of a dirty gray or yellow, and is less dense, moist and not depressed below the surface of the surrounding myocardium.

The central portion of the heart is more frequently involved than the periphery, the order of frequency being the left ventricle, the papillary muscles of the mitral valve, the interventricular septum, the walls of the left ventricle and finally the walls of the right ventricle When sclerosis involves the septum or ventricular walls, it usually affects the inferior third of the organ, as this region is supplied by the anterior ventricular artery, a branch of the left coronary, which artery is frequently affected by vascular lesions. In forty-four arteriosclerotic hearts, thirty-one showed marked involvement of the left coronary; in six cases both coronaries were equally affected, and in seven the posterior coronary was not affected. Small lesions situated in important parts of the myocardium produce more serious symptoms than larger lesions elsewhere. As the coronary arteries are frequently endarteries, when their walls are thickened and the lumen diminished or obliterated, the degenerated myocardium supplied by such a vessel receives but little nourishment from the surrounding vessels and occasionally there is produced a genuine necrobiosis.

FATTY DEGENERATION OF THE HEART may be circumscribed or duffused, primary or secondary. The heart is usually enlarged, although it may be normal and in well marked examples of the diffuse form, the color is grayish yellow, the muscles relaxed, flabby, soft and friable. The unsupported heart falls into a shapless mass and upon section the sharp edge of the cut surface is absent. The hand recognizes the presence of fat, which may be seen upon the knife or floating upon the alcohol in the vessel in which the heart is contained. From this extreme degree of fatty degeneration of the heart, the amount of muscle involved may vary and even be so small as to be only recognizable microscopically. The areas of fatty degeneration are irregular in size, shape and distribution, although they are more commonly seen in the left ventricle, the papillary and pectinate muscles, and beneath the endo or pericardium when these membranes have been inflamed. Frequently there is a yellowish mottling in streaks or patches. This degeneration is found in (1) toxic conditions, such as alcohol, phosphorous, arsenic and sulphuric acid poisoning; (2) infections, such as acute yellow atrophy of the liver, infective fevers, such as diphtheria, puerperal fever; (3) dyscrasiæ, such as occur in severe malnutrition from any cause, tuberculosis, carcinoma, diabetes, old age. Local anemia from obstruc-

tion of the coronary artery, or severe long continued general anemia, from any cause, as for example, pernicious anemia, may cause fatty degeneration.

Arteriosclerosis is more apt to produce cardiofibrosis, but occasionally fatty degeneration is also associated. Under such circumstances the cause of arteriosclerosis may be the remote causes of fatty degeneration. Fatty infiltration and hypertrophy of the heart, from chronic heart disease, is frequently associated with fatty degeneration of the heart. The heart is usually enlarged although it may be normal in size. The apex beat is usually invisible and cannot be palpated, the first sound of the heart is exceedingly feeble and valve-like and the aortic second may be accentuated. Not infrequently an apex systolic murmur is audible, due to dilation of the left ventricle.

FATTY HEART OR OBESITAS CORDI may exist (1) as a simple increase in epicardial fat which may envelop the entire heart, or follow the grooves of the bloodvessels on the surface of the heart and has been designated by Anders as Subpericardial Overfatness; (2) as an infiltration, the fat extending between the muscle fibers, occasionally as far as the endocardium, especially when the right ventricle is involved. Microscopically, the muscle fibers may show atrophy or fatty degeneration. The heart is usually relaxed and dilated.

This condition occurs in obesity with anemia and may be inherited, or acquired by overeating or overdrinking, excess in the use of alcoholic or malt liquors in those past middle life, following a sedentary occupation. It frequently occurs in women at or after the menopause, and according to Forschheimer, it is almost three times more frequent in males than in females. Eighty per cent. of the cases occur between the fortieth and seventieth years. Romberg believes that cardiac insufficiency in the obese is caused by the relative smallness and weakness of the heart muscle due to the disproportionate demand made upon the circulation by general corpulency and states that it usually occurs in the obese who are indolent, sedentary, overindulgent in food and drink and in those whose musculature is flabby, and is especially common when anemia is present. In the active and muscular obese individual, the heart muscle increases in size in accordance with the demands made upon it by the increase of fat.

BROWN ATROPHY OF THE HEART occurs most frequently in senility, and also in the later stages of chronic valvular disease, tuberculosis, carcinoma, etc. The heart is dark red-brown in color, small,

hard and wrinkled, and has been compared to a dried pear. The muscle fibers show yellowish brown pigment, chiefly around the nucleus. It is frequently associated with fatty degeneration of the heart.

AMYLOID DEGENERATION OF THE HEART occurs in the intermuscular tissue, bloodvessels and beneath the endo and pericardium, and does not affect the muscle fiber. It is due to the same cause which produces amyloid degeneration elsewhere, and is of rare occurrence.

HYALINE DEGENERATION OF ZENKER, according to Osler, is sometimes met with in prolonged fever. The affected fibers are swollen, homogeneous, translucent and the striæ are very faint or absent. It is usually associated with parenchymatous and sometimes with amyloid degeneration of the heart.

CALCAREOUS DEGENERATION OF THE HEART is a rare disease in which the myocardium is infiltrated with lime salts.

The limits of this paper do not permit of a discussion of the relation of myocardial disease to the nervous system.

DIAGNOSIS OF MYOCARDIAL DISEASE.—An absolute diagnosis of the different myocardial inflammations and degenerations cannot be made, but a probable diagnosis is sometimes possible. Extensive disease of the myocardium may be present with few or no symptoms, and a small lesion situated in an important part of the heart may induce urgent and distressing symptoms or sudden death. The symptoms of myocardial disease may be present and the autopsy demonstrate its absence and *vice versa*. Cabot's statistics show that in ten cases the autopsy confirmed the diagnosis, in three the autopsy showed no myocardial disease and in five in which myocardial disease was discovered at autopsy, no diagnosis was made during life. Occasionally in the midst of apparent good health, death from myocardial disease may occur from asystole or angina pectoris. Cardiac weakness may be the only sign of advanced myocardial degeneration in terminal pernicious anemia. The symptom-complex may be the same in various affections of the myocardium and the same disease may present different clinical pictures. Babcock well says that in no disease does the diagnosis depend more upon judgment and experience than in myocardial affections the diagnosis of which often resolves itself into a question of probability. Many cardiac symptoms in elderly individuals are due to myocardial disease rather than to endocarditis which is so frequent in the young.

The muscles, circulating fluid and the nerves must each be considered in the clinical study of myocardial disease.

When from any cause dilation occurs in myocardial disease sudden death may occur or the symptoms and signs of dilation may be the first clinical manifestations of disease of the heart muscle.

The difficulties of diagnosis are well illustrated by the following case:

A man, aged 40 years, a West Indian by birth, who gave a history of careless living, coupled with various excesses. He denied syphilis. When examined he complained of no symptoms referable to the heart, but showed to an extreme degree all manifestations of terror in anticipation of his execution by hanging the following morning. He was above the average height, well built and was fairly well nourished. Examination showed a feeble apex beat, which was slightly displaced to the left. The heart dulness was increased to the left, the first sound was feeble and resembled the second. A systolic murmur was heard at the aortic cartilage and was transmitted into the vessels of the neck and the aortic second sound was accentuated. The peripheral arteries showed moderate fibrosis.

The antemortem diagnosis was arteriosclerosis, aortic valve sclerosis and cardiofibrosis. The pathologic diagnosis was moderate arteriosclerosis, moderate dilation of the arch of the aorta, no sclerosis of the aortic leaflets nor cardiofibrosis, left ventricular hypertrophy and dilation with a normal myocardium. The weakness of the first sound of the heart was probably due to slowing of the systole from inhibition due to terror. The aortic systolic murmur was due to dilation of the arch of the aorta.

A case that has been published in full elsewhere, under the care of Dr. Leopold, illustrates the latency of cardiofibrosis.

The patient was a syphilitic alcoholic, aged 54 years, who suffered from an obscure attack of heart trouble 4 years before death, from which he nearly perished and afterwards remained in good health until his death. One year later he was examined for life insurance and was considered a good risk. Early one morning, after a wakeful and restless night, he became unconscious with cyanosis, no radial pulse distinguishable, heart sounds slightly accelerated, shallow respiration, absence of pupillary light reflex. In a few minutes he regained consciousness and after a movement of the bowels he again became unconscious, with complete muscular relaxation, and the attending physician thought he was dead. A partial reaction followed free stimulation. Vomiting occurred, each act of which was followed by syncope. The pulse rate was 25 to 30 per minute; cardiac sounds were indistinct, and moist rales were observed over the bases of the lungs. The entire skin surface was cold from beginning to end. At 8.30 A. M. the patient was conscious and stated that he felt badly but experienced no pain. Vomiting continued and 16 hours after the beginning of the attack the patient was fairly

comfortable, although there was cyanosis, cold extremities, a pulse rate of 55 per minute, occasionally disappearing, and contracted pupils. Three hours later the radial pulse disappeared, the extremities became cold, cyanosis deepened, respiration 45 to 50 per minute and death occurred suddenly. The autopsy showed extreme obstruction of the right coronary artery, the orifice of which was narrowed to a size permitting of the passage of a hair-pin and the walls throughout its entire length showed obliterating endarteritis with the local enlargements almost occluding the lumen of the vessel. The left coronary artery showed well marked fibrosis at a point below the giving off of the left interventricular branch, the vessel was entirely occluded by a recent thrombosis. The interventricular septum was occupied by a large, white, irregularly-rounded area of fibroid degeneration, measuring 2x2½ inches. A fleshy column passing from this region to the opposite wall had also undergone fibroid changes, as well as a portion of the wall of the left ventricle, which was aneurysmal. Sclerosis was so extreme and extensive that there could be but little doubt that at the time of the physical examination, 3 years before death, there was considerable cardiofibrosis, during all of which time there were no symptoms.

The most important symptoms of cardiac insufficiency in myocardial disease are tachycardia, irregular or feeble small pulse, gallop-rhythm, dyspnea which may be continuous, paroxysmal, nocturnal or induced by slight exertion, arrhythmia, bradycardia, cardiac pain or distress, angina pectoris, palpitation, edema, cough from pulmonary congestion; and Stokes-Adams syndrome, (tachycardia, feeble small pulse, dyspnea and arrhythmia). Krehl considers arrhythmia as pathognomonic and others believe it evidences involvement of the auricles. Arrhythmia may be the only sign of this disease. Examination shows a weak heart, which is usually enlarged, and there may be more or less edema.

When, in the absence of renal disease, the symptoms of acute cardiac insufficiency occur, with or without valve murmur, in the course of the infectious fevers, pyemia, gonococcus infection or acute peri or endocarditis, together with signs of an enlarged weak heart, acute interstitial or parenchymatous myocarditis may be present. Some believe that the failure of the pulse to increase in frequency in changing from the recumbent to the sitting posture, is an early sign of myocardial disease.

Fatty degeneration of the heart may be suspected during the course of acute yellow atrophy of the liver, infective fevers such as diphtheria, puerperal fever, and in the dyscrasias, such as tuberculosis, carcinoma, diabetes, old age and in poisoning by alcohol, phosphorus and arsenic. It is especially apt to occur in pernicious anemia. The

usual signs of cardiac insufficiency may be present and Cheyne-Stokes breathing is not uncommon.

Fatty heart may occur in those who appear well nourished with pallor or cyanosis, dyspnea, especially on exertion, vertigo and attacks of palpitation when at rest or after exertion. The pulse is soft, very rapid, nonresistent, hypotension, and there may be tachycardia. and in certain cases bradycardia, with a pulse rate of forty-eight per minute. Accentuation of the pulmonic second sound may be caused by congestion of the venous system, shown by the presence of hemorrhoids, varicose veins, etc. The apex beat is usually invisible and cannot be felt and the area of cardiac dulness is usually enlarged. The muscular element of the first sound of the heart may be greatly diminished, in other words the physical signs of a weak heart.

It must not be forgotten, however, that the apex beat may be lost because of the excess of fat in the chest wall, cardiac dullness may be enlarged and widened, due to the excess of fat in the abdomen, pushing the diaphragm upward and so placing the heart horizontally, thus simultating the percussion outline of an enlarged heart. A feeble cardiac first sound may be due to excess of fat in the precordial region and a weak pulse may be due to excess of fat around the radial artery. Dyspnea may be due to the excess of fat on the body, interfering with the action of the heart and lungs.

Diagnosis depends upon the existence of obesity, the habits of the patient, cyanosis and angina pectoris, especially when it occurs while at rest, bradycardia, tachycardia and arrhythmia.

Brown atrophy of the heart, when it occurs in the aged or during wasting diseases, such as tuberculosis or carcinoma may be suspected, when, in addition to the symptoms of cardiac insufficiency, physical examination shows a decrease in the size of the heart. When this degeneration is secondary to chronic valvular disease the heart may be enlarged.

Abscess of the heart, segmentation and fragmentation, amyloid or calcareous degeneration are only recognized at autopsy.

Remarks Upon Certain States of Vascular Spasm and Fibrosis.

BY H. A. HARE, M.D.

I wish to discuss in this paper certain conditions of the circulatory apparatus which, I think, receive too little attention from the profession and from the text-books and manuals from which we are wont to refresh our memories. The cases to which I refer represent conditions which are certain to affect a fairly large proportion of all the men in this room if they live beyond middle life, for these states are, to a certain extent, coincident with the onset of old age, and old age comes to some at fifty and to others at eighty. Furthermore, these conditions are peculiarly prone to arise in four pursuits of life, namely, in the banker or broker, the iron-master, the lawyer and the physician. This susceptibility depends upon the fact that they are subjected to great nervous and mental strain, and some of them are individuals who partake liberally and constantly of alcohol and rich food, the latter often being eaten when the system is ill prepared to deal with it adequately. The condition is met with not rarely in other persons, but it is in these four classes that it occurs oftenest. In most of them the vessels, the kidneys, and the heart form a triad of morbid change, but in some the heart and kidneys primarily escape, the vascular lesion being the chief change from the normal. With the state characterized by disease of the triad just named we are all familiar, and it is often difficult to determine which one of the triad first suffered, for when first seen by the physician all three are so equally affected that the process may be said to be coincident. With this type it is not my intention to deal, save to point out that they differ materially in their clinical history from the cases I shall describe, more particularly as to the duration of life, which is nearly always short.

I wish to speak of that class of cases in which the vascular symptoms so largely predominate that there can be no reasonable doubt that the lesions are primarily in the vessels rather than in the kidneys. Further, I intend to discuss but one type of these cases, namely, those in which there is an immoderate degree of arterial tension without any renal lesions which are demonstrable by the ordinary symptoms or by urinary analysis. In these cases the state of the bloodvessels is nearly always the same, although it differs in degree, and the heart may secondarily present signs of hypertrophy, or feebleness from fatigue or degeneration.

The cases on which these views here discussed are based have been met with during a space of several years, and some of them have been studied with my friend, Dr. de Schweinitz, who has examined them from the standpoint of the ophthalmologist, while I have seen them through the glasses of the medical clinician. In other instances the cases have been studied with the aid of Dr. Stanton, whose work with the sphygmomanometer has so well qualified him to study the arterial tension as we meet with it at the bedside or in the consulting-room.

To express the matter briefly, we meet with three types of cases of high arterial tension: (1) Those in which persistenly high tension is a result of spasm due to prolonged nervous stress combined with certain abuses as to habits of life, food and drink. (2) Those in which tension is high because in addition to spasm there is gradually developing, or has already developed, fibroid change in the vessels. (3) Cases in which, after a prolonged period of high tension, persistent low tension more or less suddenly develops in which the arteries are relaxed and distended, so that they resemble veins to some degree in their caliber and compressibility.

The first class, in which the tension is chiefly due to spasm of the vessels, is met with in middle-aged men who lead lives calculated to throw great strain upon the vascular system, as brokers and physicians. In these cases fatigue is often overcome by stimulants, and the physician does not see the case until an attempt to improve the health by violent exercise causes dyspnea or cardiac distress. These cases usually show only moderate degrees of abnormally high pressure, rarely exceeding 150 or 160 systolic. Auscultation reveals an accentuated second sound, an accentuated first sound, and some hypertrophy, as evidenced by a forcible apex beat. Occasionally a beat of the heart is missed, as if the heart was tired or discouraged at the perpetual effort against an abnormal *vis a fronte*. If these cases will rest from severe exercise and business stress, and take the nitrites, with no stimulants, they speedily improve and often get back to a normal state. The tension is due to spasm of the vessels and not to well-developed fibroid change.

The second type, in which there is both spasm and fibroid change, presents different symptoms according to the degree of these two abnormal states, and they respond to treatment readily if the spasm factor is uppermost, and but slowly, or not at all, if the fibroid change is most marked.

The third type is represented by the following cases:

A man of 57 years, an iron-master by occupation, who had been a constant user of whiskey in moderate quantities every day for many years, presented himself in my consulting-room in April, 1905, with a history that he had been for several months suffering from "asthmatic attacks." These attacks were not true asthma, but of the nature of cardiac oppression with dyspnea. He was lean and showed evidences of nervous stress. His urine had contained albumin, but did not when he came under my care, and has not since. A physical examination revealed a very sharply accentuated aortic second sound and very tense vessels, so tense that the radials could not be closed by pressure with the fingers. The apex beat was very forcible, but not diffuse. There was marked cardiac hypertrophy. An estimation of his pressure at this time with the sphygmomanometer showed that his high, or systolic, pressure equaled 225 millimeters of mercury, with a low pressure of 155. At times the high pressure would rise with nervous excitement to the remarkable height of 255 millimeters, showing not only vascular spasm but the presence of a powerful left ventricle. He was placed in bed, given a rest-cure with massage and alterative treatment, and in two weeks the pressure was reduced to 200 high and 130 low. This was the lowest point to which I could reduce the pressure, even when large doses of nitroglycerin, sufficient in size to make his head ache, were given. He returned home very much better as to his own sense of health, but came back in six weeks with a pressure of 225 high and 145 low, with some beats at 215 high. A month later with little treatment he again returned with a pressure of from 230 to 205 and a low pressure of 140. He could not remain for active treatment, and during the summer had several attacks of cardiac asthma. In last October he returned for further examination. At this time it was evident that his heart and large vessels had yielded to the great strain thrown upon them. The first sound was not so good as before, and the apex beat was much more diffuse. The tension was noticeably lower, and the sphygmomanometer showed a pressure of 190 high and 135 low. Under the free use of nitroglycerin and rest in bed it fell in 48 hours to 170, with occasional beats at 190 and a low pressure of 130 to 135.

There are several points in connection with this case which are of interest aside from the fact that his pressure was as high as 225 millimeters of Hg when his heart was equal to its work. First, the value of rest in reducing pressure; second, the fact that as the high pressure fell the low pressure remained about constant, varying from 130 to 145; or, in other words, treatment was able to lower his systolic pressure from 40 to 50 points, but did not alter his diastolic pressure more than 10 or 15 points. When, however, the heart began to fail under the strain, the sytolic pressure fell to 190 under excitement,

and 170 when at rest. Again, tracings at this time showed that the heart action as to rhythm and force was impaired and the case illustrates the type already named in which the pressure is not due to spasm alone, but to fixation of the smaller vessel walls, by fibrosis, so that vascular relaxants cannot do much good. When the heart was given another period of rest, with a little digitalis to support it, and nitroglycerin was freely used to prevent rise of tension from spasm due to digitalis, it was found possible to greatly improve the first sound, to diminish the signs of cardiac dilation, and to give the patient much cardiac comfort. Finally, this case is of great interest in another respect, namely, that it illustrates a type in which nitroglycerin, in any dose which is compatible with the comfort of the patient, fails to lower tension because the change in the peripheral vessels is essentially one of fixation by fibrosis and not by spasm. This is an important therapeutic point, showing that the physician can expect nitroglycerin only to reduce the part of the hypertension, which is due to spasm and not that part due to fibroid change. The latter state is largely beyond the influence of medicinal agents unless it be the iodids. On the other hand, the combined effect of rest, massage and iodids will often, even when fibrosis is well developed, not only produce excellent results, in that the state of a tired heart is improved, but also result in a marked diminution of arterial tension partly by a cardiac and partly by a vascular influence. Thus I have in another case for three consecutive years been able by such a course of treatment to so lower arterial pressure that the anginoid attacks due to spasm and fibrosis have been prevented from occurring for months at a time, a fall in both the systolic and diastolic pressure, amounting to 15 mm. of Hg, being maintained for months by treatment by drugs. This case is also an excellent example of the manner in which the heart may escape serious lesions even when the vessels are gravely affected, for although he has had an aortic systolic murmur due to aortitis for several years and a systolic pressure of 170, or over, he has recently passed through an operation for purulent peritonitis due to appendicitis, during which a German surgeon, called in an emergency, and ignorant of his vascular state, gave him chloroform for one and a half hours. Chloroform, because of its depressant effect upon blood-pressure, was perhaps safer than ether, but I should have considered that the heart was in too serious a state to permit of the use of such a cardiac depressant as the first named drug. In other words, if this case had been one in which the heart, kidneys and vessels

were all involved together in the sclerotic change, he probably would not have survived the operation.

Another case which has been under my care for a very much longer time also illustrates the fact that the most remarkable changes may take place in the vessels, without the heart undergoing fatal change, provided only that by some good fortune the coronary vessels and communicating fibers of his heart suffer slightly.

In December, 1900, I first saw Mr. H., a banker from the western part of this State. At that time Dr. de Schweinitz stated that he presented typical Gunn's vessels. There was an extraordinary degree of arterial pressure, which made it impossible to close the radials by pressure with the fingers. As the sphygmomanometer was then little used in medicine, no records were made. At his second left costal cartilage an aortic systolic murmur, chiefly heard on expiration, was noticed. It was undoubtedly not valvular in origin. The urine contained a very faint trace of albumin. His heart was greatly hypertrophied and dilated, resembling the "ox heart" of aortic regurgitation, but there was not then, nor has there been since, any sign of that valvular lesion. He was given gradually ascending doses of nitroglycerin to lower tension, and aconite to diminish the excessive cardiac impulse, which was so great that it forced my head to and fro whenever I listened to his heart. Partly for his general vascular state but particularly because of the retinal hemorrhages which he presented, he was also given full doses of sodium iodid. Under this treatment at the end of 6 months the aortic murmur had almost entirely disappeared, and the second sound was not nearly so accentuated. At the end of 2 years he was taking 10/100 of nitroglycerin and nearly a grain of the solid extract of aconite 3 times a day. He stated that he was feeling remarkably improved, but 5 months later he showed a most extraordinary degree of arterial tension, and a degree of cardiac hypertrophy, which was also remarkable. The nitroglycerin was increased to 12/100 a day, and the iodid and aconite maintained. As after a few days these doses did no good, the nitroglycerin was increased to 8/50 a day, and soon after to 12/50 and then to 14/25. Finally, 3 years after treatment was begun, the dose amounted to 12/10 a day. Albuminuria varied in degree through these 3 years. Often it was absent, rarely it was marked, sometimes it was a mere trace. In March, 1903, his tension was not worse and his heart's action still forcible. At this time Dr. de Schweinitz wrote me as follows:

"Mr. H. certainly presents the most astonishing appearance of high tension. I do not know when I have seen such an outlining of the superficial vessels. Curiously enough, his eyes are not any worse than when I reported to you last. There are a good many hemorrhages in the right or better eye, but not more than there were last spring. The left eye shows a most elaborate development of the so-called proliferating retinitis, which is a sequel of retinal hemorrhages."

Seven months later, in October, 1903, Dr. de Schweinitz wrote again:

"The vision of Mr. H.'s right eye is perfect, and the retina entirely clear of any hemorrhages or exudates, with the exception of one small spot in the lower portion of the retina, which has been there for a long time. The retinal circulation is good, considering all things. I do not mean that there is no compression by sclerotic arteries, but there is no excessive compression. The condition of the left eye remains about the same, the proliferating retintis the result of the former hemorrhages not having increased. It is, however, in so far as its response to remedial agents is concerned, not to be influenced, as it represents a connective-tissue formation. I do not see any fresh hemorrhages. On the whole, I think the eye report is a satisfactory one and conforms to the improvement which I learn from you has taken place in the general condition, which I myself observe."

A year later, namely, in October, 1904, when he presented himself the picture had changed greatly, and he showed the signs of *ruptured compensation* not only as to his heart *but as to his large vessels*, a condition which I think deserves more attention than it receives. The area of cardiac dulness had greatly increased, and the apex beat was very diffuse and quite feeble. He felt weak, was easily exhausted, and seemed ill. His temporal arteries, which had heretofore been like whipcords, were now distended and looked like veins. They were soft and relaxed. At the apex of his heart a distinct systolic murmur, due to insufficiency at the mitral orifice, could be clearly heard. He was placed in bed and given a rest-cure with strychnin and cactus. The aconite and nitroglycerin were stopped, but the iodid was continued. A general fibroid change in all his joints was noticeable. His spine was stiff and curved, as in spondylitis rhizomelique. He improved greatly as to the tone of his vessels and his heart under this treatment, and returned home.

On his return in May, 1905, I had made the first estimation of his arterial tension. The high or systolic pressure was 180, the low 130, but the heart had apparently rallied to the strain a second time, and Dr. Stanton reported that he had never seen such extraordinary pulse waves; they amounted to 22 millimeters of mercury at a stroke. The large vessels were relaxed and distended, and the enormous pulse wave was clearly to be seen in them. In other words, the heart regained its power, the large vessels were relaxed, but the peripheral resistance and rigidity of the arterioles were great.

In October of this year the results with the sphygmomanometer were the same as to pressure, namely, 185 high to 135 or 140 millimeters low, but the heart was much more regular in its action and the individual pulse beats were more regularly as to force. An examination of his vessels and of his tension revealed still more improvement during the present month.

There are many points of interest in this case, therapeutic, diagnostic and prognostic. Therapeutically it is of interest because of

the large doses of nitroglycerin which he took, over a grain a day, without any considerable symptoms, although they produced but little effect on tension, because the tension was due more to fibroid change than spasm; second, the fact that these full doses of nitroglycerin diminished sexual power, and caused a state of vesical feebleness so that it became difficult for him to hold and pass his water; and third, because his cardiac hypertrophy was so excessive that large doses of aconite did not materially reduce his heart's action.

Pathologically the case is of interest because it manifested cardiac hypertrophy of an extraordinary degree to meet arterial stress. The coronary vessels must have largely escaped to permit of this hypertrophy. Again, a time came when compensation finally ruptured in both the heart and large vessels, all of which yielded to the strain, although the peripheral arterioles remained narrowed by reason of fibrosis. In other words, the interesting point appears that during excessive peripheral resistance the heart and the arteries first increased in power side by side, but finally the large vessels relaxed, or dilated because of fatigue, as did also the heart, which is after all only a specialized part of the vessels.

So far as I know this point as to the possibility of rupture of compensation in the muscular fibers of the larger bloodvessels is a new one.

Given a case of cardiovascular fibrosis of this sort, in which there were repeated hemorrhages into the retina in 1900, no one would have supposed that life would last for so long as five years. Indeed, a case was seen by Dr. de Schweinitz and myself a short time before which impressed upon us the grave omen of Gunn's vessels with retinal hemorrhages, for in this case, which presented far less degenerative change in the peripheral arteries, sudden death took place during sleep within a few weeks. This latter case presented the type in which the vascular lesions were less advanced than the changes in the heart, whereas the case I have just cited at length represented the type in which the heart escaped the touch of the arterial change, which was general throughout the system. In other words, the duration of life in these cases depends upon three important factors, namely, the escape of the heart muscle and its coronary vessels from the blight of degenerative change, the escape of the kidneys from fibroid change, and the escape of the cerebral vessels to such an extent that they can resist the pressure and so protect the patient from a fatal cerebral hemorrhage.

As illustrative of the prognostic value of Gunn's vessels and reti-

nal hemorrhages I may quote some statistics collected for my book on the Practice of Medicine:

"Belt collected 419 cases, of which seventy-two per cent. died within one year and 90 per cent. of the remainder died within two years. The cases reported from Haab's practice by Possauer showed that none of the men applying to the clinic for treatment lived more than two years; of the women, 68 per cent. died within the same period of time. Of private patients who could live comfortably, only 59 per cent. of the men and 53 per cent. of the women had died at the end of two years. Gruening collected 100 cases, none of which survived more than two years after retinal changes began, and Bull found that sixty-nine out of 103 cases died within two years. Of the remaining thirty-four, seventeen died after a longer period, and seventeen were alive at the time his paper was published. Harlan analyzed forty cases with the following results: Thirty-three ended fatally at various periods averaging four months; three lived a year after the discovery of retinal changes; three recovered, and one regained his eyesight, although the urine was albuminous at the end of two years. Miley traced forty-five cases, and found the average duration of life to be less than four months from the time eye changes were first observed. One of his patients lived eighteen months and two fourteen months, but all the others died within a year."

Some of these statistics have been adversely criticized, but they point a way toward prognosis even if they are partly incorrect. I believe that we cannot reach definite conclusions as to the value of Gunn's vessels and hemorrhages into the retina until we have statistics as to the associated state of the kidneys. If these organs are normal or approximathely so, the prognosis is much better, for obvious reasons, than if they are diseased, in which case a duration of life of a few months is probable.

Finally, the points I wish to emphasize are as follows:

(1) In cases of high tension due to fibrosis the nitrites can be of but little value, and the iodids with rest and massage are needful.

(2) Cases of *very* high tension are usually those in which the heart escapes sufficiently to help maintain the tension.

(3) As fibrosis in the peripheral vessels increases, the muscles of the larger vessels undergo hypertrophy, as does that of the heart.

(4) It is quite as possible for vascular compensatory hypertrophy to rupture as for the cardiac compensatory hypertrophy to do so.

(5) This rupture of vascular hypertrophy often gives the heart a rest and permits it to recover from its fatigue, and so life is saved.

(6) It is possible, if the peripheral fibrosis is arrested, for the vessels also to regain power and a general improvement to ensue.

(7) The cardiac stimulants are not needed in these cases as much as rest and the skilful use of alteratives and vascular sedatives.

DISCUSSION.

DR. J. C. WILSON: I am not quite sure that Dr. Stengel has made it particularly easy for the clinician to recognize the symptoms of arteriosclerosis under all circumstances; but the effort to recognize the conditions of ill health which Dr. Stengel has suggested as occurring as the result of such arterial change should be systematically made by all clinical workers. In a certain group of cases it seems to me it is the duty of the physician to utter a word of warning even when definite symptoms have not yet shown themselves.

It is interesting to reflect upon the statements that arteriosclerosis is not always a generalized process. I think often the failure to recognize this fact leads to the belief that the local manifestations are merely a part of a general process.

Perhaps in no group of cases outside the general infections is the nosologic division of disease more important than in arteriosclerosis. The disposition to look upon the clinical conditions as the result of disease of the heart, nervous system, kidneys, etc., when these symptoms are really a manifestation of a general condition, is one which ought to be discouraged.

I am sure, from clinical observation in large hospital wards, that the conditions of privation, of political disability and of social life which have impelled large immigration to our shores in the last generation have induced in these immigrants arterial changes which, in those situated in a more fortunate environment, are the result of the excessive use of alcohol, of overfeeding or of the strenuous life. I am sure that many of these immigrants suffer from a general arteriosclerosis, which is not at all unlike the senile arteriosclerosis with which we are familiar. We find arteriosclerosis of high grade in such people very often in the fourth and fifth decades of life. Consequently, I think that the visceral diseases for which such patients apply for hospital treatment and under which the cases are variously diagnosticated and classified are much more difficult to deal with than similar conditons in individuals at the same period of life who have spent their time under more fortunate circumstances.

DR. G. E. DE SCHWEINITZ: The opthalmoscope in a peculiarly happy manner affords an opportunity of studying the leisons of arteriosclerosis in the retinal vessels. These studies give aid, in the first place, in diagnosis, particularly in the so-called preliminary stage of arteriosclerosis. Second, they aid in shaping a prognosis in the manner which Dr. Hare has already made plain. Finally, they are of some value in estimating

the results of the therapeutic measures which have been adopted to control the disease. We are especially indebted for recent studies under these conditions to Mr. Marcus Gunn, whose admirable classification of the lesions is somewhat as follows:

(1) Alterations in the course, caliber, size and breadth of the retinal arteries, tortuosity and beading of the vessels being prominent signs. (2) Alterations in the reflections and translucency of the walls of the retinal arteries, manifesting themselves in increased distinctness of the central light streak, loss of the translucency of the artery and positive changes in its wall, consisting of whitish stripes indicating degeneration of the walls or infiltration of the perivascular lymph sheaths (perivasculitis). To some of these vessels, on account of their appearance, the name silver-wire artery has been given. (3) Alterations in the course, caliber, size and breadth of the retinal veins, associated with alternate contractions and dilations, exactly as they occur in the arteries. Added to these phenomena is the one which is of the greatest importance, namely, an impeded venous circulation where a diseased artery crosses. Ordinarily, as an artery crosses the vein there is no sign of pressure, but if the artery is stiffened or thickened by disease, it presses upon the vein, pushes it aside, or directly contracts its caliber, so that beyond the point of crossing there is an ampulliform dilation. The veins may also exhibit those signs which indicate degeneration of their walls and often are affected with one or more varicosities. Finally, we may have edema of the retina, especially in the neighborhood of the papilla, hemorrhages, and roundish yellow and white, sometimes drop-like, infiltrations. Among the very earliest signs of arteriosclerosis, even before the stiffening of the arteries and pressing upon the veins occurs, are the fine, corkscrew tortuosity of the small macular vessels and a curious brick-red congestion of the nerve-head.

Referring to the question of the value of these examinations to determine the effect of remedial agents, I may say that one frequently sees under their influence improvement in the general arterial circulation, disappearance of hemorrhages and exudates, lessening of so-called capillary congestion, but so far as my own observation is concerned, when once the artery has been decidedly stiffened and distinctly impresses itself upon an underlying vein in the manner already described, this phenomenon does not entirely disappear.

DR. WILLIAM B. STANTON: My work in regard to arteriosclerosis has to do chiefly with the conditions of the blood pressure and the pulse. I had had the opportunity of seeing the cases mentioned by Dr. Hare, one of which was specially remarkable on account of the great height of the blood pressure. It was by far the highest I have ever seen.

Certain observations in regard to pressure estimations may be of interest to those who are working along these lines. In cases of high pressure showing symptoms there is often difficulty in estimating the high and the low level. Repeated tests fail to give a clearcut figure. This is due to the fact that, in most cases of high pressure, it will be noted that, when the pulse beats come through after occlusion of the

artery, only every second beat, perhaps still fewer, can be felt, and, as the mercury gradually falls, every beat comes through. I was at first inclined to attribute this to the action of the breathing, but in some pulse tracings it will be noted that every other beat shows slight diminution. Besides this feature there is, in the cases showing symptoms, a wide variation as to the point at which the high pressure is found. Thus, in one of Dr. Hare's patients, the least excitement would bring about a marked increase in pressure, and, during a number of estimations there would be a variation of 20 to 30 mm. in the high average. Along with this variation under slight excitement there may be a corresponding tendency to undue rapidity of the heart. With improvement, the first sign is what may be designated as stability of the pressure, that is, the pressure limits are easily determined and variations under slight excitement do not occur. This change may take place without any diminution in the amount of pressure. It had formerly seemed to me that this irregularity of pressure was an evidence of weakened heart action, though many times changes in the heart could not be found and there were no evidences of cardiac failure. Dr. Hare's explanation of vascular insufficiency suits this perfectly.

DR. JOHN H. MUSSER: It seems to me that in the early periods of arterial disease the classification can only be an etiologic one, particularly if we recognize this process in its various stages and expect to do any good at all in the relief of the patient we must determine the etiologic factor. Therefore, while it is even late and the process may be only compensatory, I consider that the essential symptom is the hypertension, and that any subdivision in the early period must be a subdivision dependent upon the cause, the toxic cause from infection, or generated within. Perhaps, too, states of the nervous system which give rise to heightened blood pressure must be considered etiologic factors. It is true that we must consider those cases in which heredity plays an important part, in whom we cannot find any definite toxic cause and, perhaps, in whom there are just such states of the tissues in consequence of which endarteritis arises from the products of metabolism. In the latter periods the classification must depend largely upon the dominating organ that gives rise to symptoms; the eye, the ear, perhaps the heart, or other organs or structures in which the process is dominant.

There recently came under my observation a case that ought to be one of the greatest encouragement to all of us. The patient had well defined arterial changes. There was extensive hypertension and secondary myocardial symptoms, the eye changes and general vascular changes that go with this general process and which, by the way, must be general. I cannot conceive that while we may find at autopsy an atheromatous patch, that there has not been a general process. The man was so desperately ill, the factor of infection being a frontal sinus, that notwithstanding the protest of relatives in another city, Dr. Freeman agreed to operate, and, with Dr. Spencer giving the anesthetic, he removed a large collection and drained this sinus with the result that in 6 months there

has been a general subsidence of all of the general arterial and myocardial symptoms, and so far as we can make out a subsidence of all renal symptoms or evidences of renal inflammation. The man is apparently well and is engaged in his practice, that of law. While he has been enjoined not to use alcohol, I am afraid he is not eliminating that etiologic factor, yet he is continuing to improve. Any one seeing him a year ago and today would not think such a change was possible.

Arrhythmia is one of the symptoms which might be discussed in association with arteriosclerosis. I think we are beginning to look upon it not as an unfortunate factor, but rather as a conservative one. It may occur in an individual in whom apparently there is no serious and progressive myocardial degeneration. We can readily understand that if with every third or fourth beat of the heart there is cessation of one or diminution of the force of one that that means a little rest, and hence there have been a number of cases under my observation for many years showing such arrhythmia even more pronounced than I have tried to describe to you. This has been rather a relief to the individual than the opposite. I believe in carefully studying cases that we can say of certain groups of them that arrhythmia need not be considered a grave symptom.

DR. S. SOLIS COHEN: I should like to ask Dr. Welch whether there is any definite information concerning the relationship of disturbance of the chromaffin system with arteriosclerosis. Through Wiesel's investigations we know that the medulla, which is the pressure-raising constituent of the adrenal gland, consists of chromaffin and that this substance occurs throughout the sympathetic system and along the vessels. We know that injection of adrenalin in rabbits produces arterial changes, not a definite arteriosclerosis, but a change. Clinically, we know that in certain cases of arteriosclerosis thyroid substance will produce amelioration of symptoms, and both clinically and experimentally we know that there is a certain degree of antagonism between the thyroid and the adrenal secretions. Furthermore, chromaffin deficiency is found in connection with hyperthyroidism, and chromaffin excess in connection with thyroid deficiency. The thymus gland, too, shares in this balanced relationship, being somewhat supplementary to chromaffin. It is of interest that when there is physiologic degeneration, *i. e.* involution, of the arteries, there is corresponding change in the thyroid gland, although other organs may not grossly manifest it. The intimate metabolism of cells and the preservation of the organic balance bears so intimately upon the question of the etiology of arteriosclerosis, which is evidently chemic in the last analysis, that I have wished to know whether there is more definite information than I have been able to find on this question. Incidentally I might emphasize the great therapeutic value of thyroid extract in certain cases of angiosclerosis—the term angio is broader and, I think, better than arteriosclerosis. Mention may also be made of erythrol tetranitrate as a substitute or succedaneum for nitroglycerin. Few books mention this drug, and these advise too large a dose. It is found in tablets of ½ grain; but an ordinary dose is only from 1-64 grain to 1-16 grain. All the nitrites, indeed, are commonly used

in unnecessarily large doses. This does not apply to exceptional cases like those narrated by Dr. Hare, whom I should like to ask to make clear what preparation of nitroglycerin he employed. As he, at least, does not need to be told, tablets supposed to contain nitroglycerin are often little more than sugar of milk; the real dose is always uncertain. For this reason I prefer to give nitroglycerin in liquid form. The one per cent. solution now official as spiritus glycerylis nitratis may be further diluted with from 4 to 9 parts of alcohol, so that the unit drop shall contain only 1/1000 or 1/500 part of nitroglycerin. I recall the case of an old lady who was supposed to have been taking 1/20 grain of nitroglycerin several times a day in 5 tablets of 1/100 grain each. But the difference in the action of the liquid preparation showed that the tablets did not contain nitrogylcerin. Erythrol tetrantitrate and sodium nitrite are to be preferred to nitroglycerin for prolonged use because their effect is slower, gentler, and more lasting. Nitroglcerin or amyl nitrite are preferable for quick result in an emergency. The association of sodium iodid and sodium nitrite is one of the best for use in presenile angiosclerosis of toxico-degenerative types. A further point upon which I should like the pathologists to enlighten us is in relation to the difference between the degenerative and the inflammatory forms of vascular sclerosis. Changes in the vessels may be due to physiologic or pathologic degeneration or may follow inflammatory processes in reaction to various forms of irritation. Thus we have the changes of normal age, those of premature age in consequence of privation, overwork or nervous strain, those of pathologic and unbalanced age due to alcohol and other toxic agents, and inflammatory changes not so closely resembling those of age, and also excitable by a multiplicity of agents, as syphilis, gout, various infections. Before we can decide upon the general course of treatment to be applied to any individual exhibiting symptoms, either early or late, of arterial change and cardiac change, it is highly important to determine whether or not the symptoms are those of a degenerative process or of a reactive inflammatory one.

DR. A. O. J. KELLY: The necessity of an early recognition of arteriosclerosis is, I think, paramount. While we have been very remiss in this particular in the past, the widespread interest in the subject manifest during recent years leads us to hope that early diagnoses in the future will to some extent make up for our remissness; but I have a firm conviction that it behooves us to investigate our patients for the early manifestations of arteriosclerosis even before they present obvious evidences of it. In patients in middle life, however remote the symptoms, we should undertake a careful scrutiny of the cardiovascular apparatus; investigate the heart and bloodvessels from all points of view, size and positon of the heart, character of the heart sounds, blood pressure, etc., so that if possible the beginnings of arteriosclerosis, that stage without noteworthy symptoms, may be recognized and appropriate treatment instituted early. Another important point is bound up with the wonderful power of the organism to adapt itself to changed conditions—a subject to which Dr. Welch several years ago especially directed our attention. The detection

of hypertrophy of the heart, for instance, is not in itself an indication for treatment directed to the heart; hypertrophy of the heart is an indication of compensation, not of incompensation; and it is our duty as physicians so to regulate matters that the hypertrophy is neither excessive nor insufficient, but sufficient for the changed conditions under which the patient lives. Finally, a word with regard to the beneficent influence of rest in disorders of the heart—in conditons of hypertrophy as well as of dilation. I am frequently lead to believe that the symptoms referable to undue hypertrophy are incorrectly interpreted and an effort made to relieve them by cardiac stimulants, whereas cardiac sedatives and particularly rest in bed are indicated and their use is followed by a speedy return to conditions of comparative comfort. The indications for such use of rest in bed and cardiac sedatives is much more common than some physicians seem to realize.

DR. WELSH: In answer to Dr Cohen, the adrenalin question is a very interesting subject, but it is not clear yet what light it sheds upon arteriosclerosis. In the experiments with injections of adrenalin in arteriosclerosis we do not know definitely to what extent the effects are due to the adrenalin. The best presentation of the question is by Ziegler.

DR. HARE: In answer to Dr Cohen, I may say that the nitroglycerin administered was not in hypodermic tablets but in gelatin coated pills, and several times tested as to its physiologic activity.

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FRANCIS T. STEWART, M. D.

COMMITTEE ON INCREASE OF MEMBERSHIP.

(For One Year.)
JOSEPH FARLEY, M. D.

(For Two Years.)
ALBERT M. EATON, M. D.

(For Three Years.)
WENDELL REBER, M. D.

(For Four Years.)
JOHN H. JOPSON, M. D.

(For Five Years.)
DAVID RIESMAN, M. D.

Also the Chairman of the Membership Committee of each of the Branches.

ATTORNEY FOR MEDICAL DEFENSE.

HON. HAMPTON L. CARSON.

FORMER PRESIDENTS

SAMUEL JACKSON, M. D., 1849-'52.
JOHN F. LAMB, M. D., 1853.
THOMAS F. BETTON, M. D., 1854.
D. FRANCIS CONDIE, M. D., 1855.
WILSON JEWELL, M. D., 1856.
GOUVERNEUR EMERSON, M. D., 1857.
JOHN BELL, M. D., 1858.
BENJAMIN H. COATES, M. D., 1859.
ISAAC REMINGTON, M. D., 1860.
JOSEPH CARSON, M. D., 1861.
ALFRED STILLE, M. D., 1862.
SAMUEL D. GROSS, M. D., 1863.
LEWIS P. GEBHARD, M. D., 1864.
NATHAN L. HATFIELD, M. D., 1865.
WILLIAM MAYBURY, M. D., 1866.
ANDREW NEBINGER, M. D., 1867.
GEORGE HAMILTON, M. D., 1868.
WILLIAM L. KNIGHT, M. D., 1869.
WILLIAM H. PANCOAST, M. D., 1870.
JAMES AITKEN MEIGS, M. D., 1871.
D. HAYES AGNEW, M. D., 1872.
WILLIAM B. ATKINSON, M. D., 1873.
WASHINGTON L. ATLEE, M. D., 1874.
WILLIAM GOODELL, M. D., 1875.
THOMAS M. DRYSDALE, M. D., 1876.
HENRY H. SMITH, M. D., 1877-'79.
ALBERT H. SMITH, M. D., 1880-'81.
HORACE Y. EVANS, M. D., 1882.
WILLIAM M. WELCH, M. D., 1883-'84.
RICHARD J. LEVIS, M. D., 1885-'86.
J. SOLIS COHEN, M. D., 1887-'88.
W. W. KEEN, M. D., 1889-'90.
JOHN B. ROBERTS, M. D., 1891-'92.
DE FOREST WILLARD, M. D., 1893-'94.
J. C. WILSON, M. D., 1895-'96.
JAMES TYSON, M. D., 1897.
EDWARD JACKSON, M. D., 1898.
S. SOLIS COHEN, M. D., 1899.
JOHN H. MUSSER, M. D., 1900.
GEORGE ERETY SHOEMAKER, M. D., 1901.
THOMAS H. FENTON, M. D., 1902.
FRANCIS M. PERKINS, M. D., 1903.
ROLAND G. CURTIN, M. D., 1904.

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